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APRIL 15, 1940

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Builders of Precision Boring and Grinding Machines

AUTOMOTIVE INDUSTRIES
of AUTOMOBILE

Reg. U. S. Pat. Off.
Published Semi-Monthly

Volume 82 Number 8

CONTENTS

Automotive Division
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Cable Address.....Autoland, Philadelphia

Member of the Audit Bureau of Circulations
Member Associated Business Papers, Inc.

Automotive Industries—The Automobile is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903, the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by
CHILTON COMPANY
(Incorporated)

Executive Offices
Chestnut and 56th Streets, Philadelphia, Pa., U. S. A.

AUTOMOTIVE INDUSTRIES. Vol. 82, No. 8. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. Entered as Second-Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In Case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, $1.00 per year. Canadian and Foreign, $2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 1, 1940), 50 cents.

IN THIS ISSUE . . .

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 82 April 15, 1940 Number 8

INVENTIONS and new scientific discoveries are the nation's number one needs, according to Dr. Charles F. Kettering, vice-president of the General Motors Corp. and general manager of its research laboratories division.

Speaking as chairman of the United States Patent Law Sesquicentennial Committee which sponsored observance on April 10 of the 150th anniversary of the signing of the first patent act by George Washington in 1790, Mr. Kettering said that in the early days of this country the greatest necessity was man power with the result that labor saving inventions and machinery were developed. Listing the inventions, Mr. Kettering said they made it possible to take abundant natural resources and out of them create all of the wealth of the nation.

"Our problem now is to supply more new labor-creating industries, like the automobile and the electrical industry, through industrial research," said Mr. Kettering. "Now we have an excess of man power, money and materials. We need more things to use up these abundant resources. We need to turn our research and development programs to supplying projects—new products and present ones in larger quantities—so that the present excess of men will be put to productive work increasing the wealth, happiness and well being of the country.

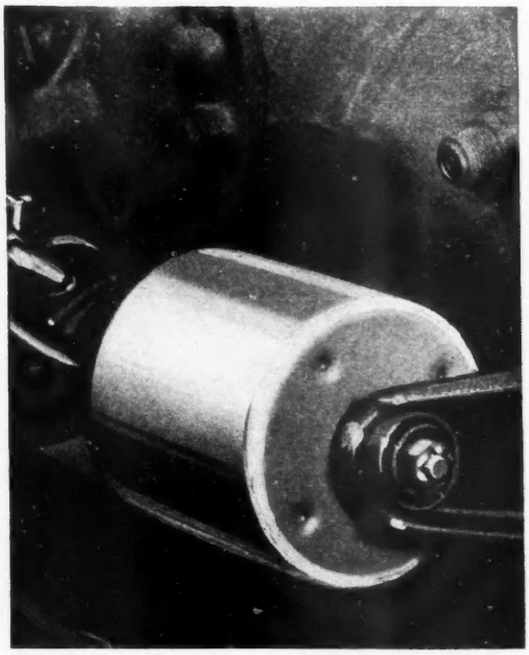
"We don't have the slightest idea of the exact nature of the things that will be needed in the future. If we knew what they were, we would be well on our way to having them now. We can say there is enough unfinished business to supply thousands of problems for industry and science to work on. No problem can be recognized as a new industry when it is in the test tube stage, but industries employing large numbers of men are founded on simple laboratory experiments. We need anything that will put men back to work.

"Every line of endeavor, business, government, science, engineering and even economics has its unfinished business. Take a few simple examples of physics. What is friction? Why is glass transparent? Why are some substances good conductors and others

(*Turn to Page* 397, *Please*)

Since 1913 all issues of AUTOMOTIVE INDUSTRIES have been indexed in the *Industrial Arts Index*, which can be consulted in any public library.

REJECTIONS CUT 2/3 on difficult draw!

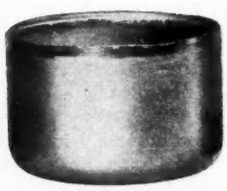


Production cost went down when Inland Hot Rolled Sheets were used to form this vacuum cylinder

Heart of the newest Automatic Gear Shift is this vacuum cylinder, a 4-inch diameter cup, drawn to a 4½-inch depth. And the call is for 8000 parts per day.

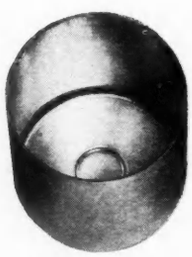
Ordinary sheets caused tremendously high breakage rates. An acceptable rejection figure was fixed at three per cent. When Inland Hot Rolled Sheets were used, the breakage was brought down to an average of less than one per cent!

That kind of performance is nothing new with Inland Sheets. That's why manufacturers come to depend on Inland Sheets to reduce production costs. They do the job better. They cut waste to the bone. They help you keep output right on schedule. Inland metallurgists are available to work out similar economies for you. Write us today.



1. First draw. Blank and cup.

2. Second draw. Draw to 4½ inches.



3. Trim flash.

4. Embossed, punched and drilled.

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AUTOMOTIVE INDUSTRIES

Published on the 1st and 15th of the month

Vol. 82, No. 8
April 15, 1940

Dealers Spurn Federal Aid

Proposed Patman bill and F.T.C. code get cold shoulder in national balloting by N.A.D.A.

By HERBERT HOSKING

By a crushing majority, automobile dealers who voted at all voted against the proposed Patman bill, which would have invited Congress to regulate factory-dealer relations in the industry. On March 9, the National Automobile Dealers Association mailed 40,729 ballots to dealers everywhere in the United States, dealers who are not members of the N.A.D.A. as well as those who are. The ballots provided for a simple yes or no on the question of opposition or approval of the proposed Patman legislation. There was opportunity to vote also on the question "do you approve any other type of Federal legislation *re* the auto industry."

Of the dealers approached, 22.4 per cent returned the ballots to the auditing office designated by the N.A.D.A. Of the ballots returned, 8128 voted against the Patman proposals; 975 favored them, making the percentage of opposition 89.3.

On the question of other federal legislation, the percentage of opposition was 89.8, with 6996 votes counted against the question and 792 in favor.

Elsewhere in this issue, you will find a statement by Mr. Patman that the method of handling the election was unfair to his proposal. Mr. Patman thus finds himself in the position of the earlier Frankenstein, who no doubt found that the monster of his creation was "misunderstood" by those it threatened to destroy.

According to Mr. Patman, the public hearings on the proposed code of fair trade practice, under Federal Trade Commission auspices, muddled the issue of the Patman bill. It would be fairer to say, we believe, that the issues muddled each other. Both the Patman proposal and the F.T.C. code were introduced to most dealers under conditions which prevented their being received with open arms. As the dust settles, it becomes more and more apparent that both of them must be considered as "program stunts" for N.A.D.A. conventions which were sadly in need of program stunts to bolster waning interest in the ability of the association to crash through with something concrete for dealer welfare.

The activities of the N.A.D.A. for the last two years

Metaphorically . . . more than 75 per cent of the automobile dealers in the U. S. tore up ballots asking their opinion on Federal legislation

GENERAL

have centered largely around the possibilities of Federal aid in this direction. With the Patman proposal and the F.T.C. code both repudiated by their early proponents, the N.A.D.A. has now appointed a new Planning and Policy Committee which will "formulate a comprehensive program for the Association based on the attitude of dealers as recorded on the question of Federal legislation."

It seems to us that the "attitude of dealers as recorded" is a pretty slim basis for future program planning. The returns from the ballot noted above indicate that less than a quarter of the dealer body will bother to vote on something which affects their welfare vitally. The voting itself says the dealers are overwhelmingly opposed to Federal legislation. It is not likely that they will find such unanimity on any other question. It is not likely either, that as many as a quarter of the dealers in the United States will bother to offer a constructive suggestion as to what they do want, or will participate in any of the plans set up by the automobile factories for the improvement of dealer relations.

Pity the Planning and Policy Committee, which once more must start over the weary road of trying to find broad, national issues which will excite to the point of action large numbers of automobile dealers, whose real problems lie in moving the stuff on the used car lot, and finding salesmen who will get off the chair when a customer walks into the showroom.

The great German philosopher Goethe once remarked that if everyone would sweep his own doorstep, the whole world would be clean. There is no better example of this homely aphorism, than the automobile dealer body. The "big" problems of the dealers are local in origin. They are doorstep matters which can yield best to local treatment. Well managed local dealer associations (including state associations) justify their origin, but not always enough to keep those who manage them from being pretty well disgusted with the whole picture of dealer desires.

It's possible that the N.A.D.A. would find its true function, purely as a federation of local associations represented by delegates. It would not have to meet except when there was something worth meeting about, and its routine functions could be carried on without the constant disturbance of "great" issues.

GM Steps Ahead with Retirement Plan

Stockholders of General Motors, on April 30, will vote on an Employes Contributory Retirement Plan, designed to supplement Social Security payments for those whose salaries exceed $3,000 per year. The General Motors picture is full of investment plans, work stabilization plans for hourly workers, and other forms of amelioration for insecurity, but this plan represents the first comprehensive effort to provide systematic retirement benefits to the broad executive group on fixed salaries.

The proposed plan will become effective, if adopted, for employes between 40 and 55 years of age, who earn salaries in excess of $250 per month. Such employes will contribute 5 per cent of their monthly salary in excess of that amount. Monthly retirement benefits will be paid out at the rate of 1½ per cent of the employe's average monthly salary in excess of $250 a month during the period he has contributed to the plan, multiplied by the number of years he has contributed.

In "normal" operation, where an employe becomes party to the retirement plan at the age of 40, and retires at age 65, General Motors intends that the employe shall have contributed nearly half of the cost of the retirement benefit.

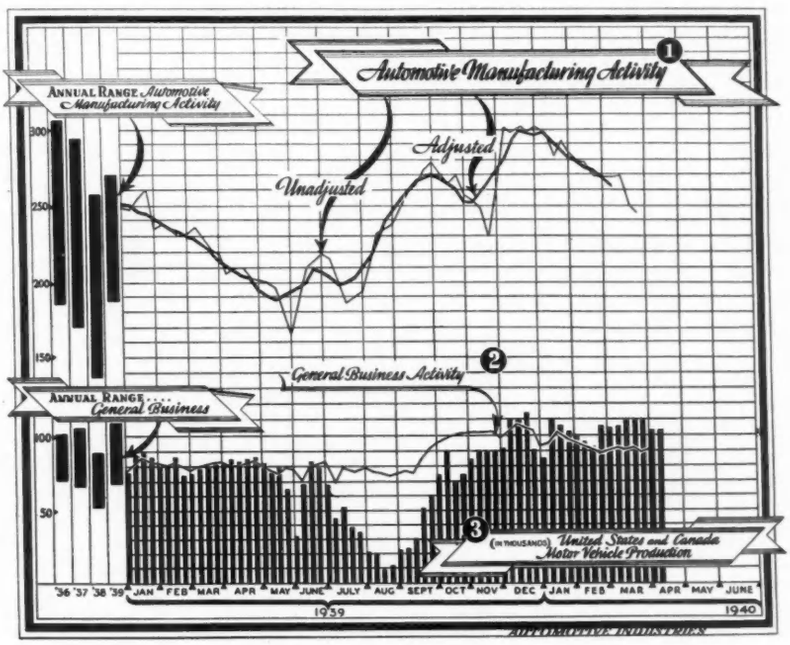
Details of the plan are described in a letter to stockholders over the signature of Alfred P. Sloan, Jr., chairman of the Corporation. Proxies with the letter offer stockholders an opportunity to vote for or against the plan, and proxies which do not specifically oppose it will be voted for the plan, which is sponsored by the management of the corporation. If adopted, the plan will become effective as of July 1, 1940.

The Brass-Hat Rack

"Look here, we're not to start making any Army soup kitchens until the government tells us to!"

BUSINESS IN BRIEF

Our own view of automotive production and sales; authoritative interpretation of general conditions



Weekly indexes of automotive general business charted

Spring Call Boosts April Production

PRODUCTION of motor cars and trucks, bolstered by favorable sales reports for March in the face of adverse weather conditions, continued at the same pace through the first half of April, with little or no slackening of activity. Factory schedules indicated an output of slightly more than 103,000[3] units for the week ending April 6, and approximately the same production rate was estimated for the week ending April 13. This presages a production total of nearly 225,000 vehicles for the first 15 days of the month.

Reflecting higher sales volume, April production may surpass that of March, when 439,100 cars and trucks were turned out, according to the official estimate of the Automobile Manufacturers Association.

Chevrolet cut its high production rate slightly as General Motors output declined to 42,800 units for the week ending April 6. Chrysler held steady at 24,500 units, while Ford was up to 23,700 units again after reverting temporarily to a four-day week. Studebaker continued to pace the independents, followed by Hudson, Packard, Nash and Willys. Graham resumed production after a nine-month lapse during refinancing operations but was not expected to get into full swing until the middle of the month.

March retail car deliveries were especially gratifying despite the late advent of spring weather in the northern states. Ford experienced the biggest month's sales since July, 1937, with the greatest volume coming in the final 10 days when most of the companies showed a decline in deliveries.

Retail sales in March of Ford cars and trucks and Mercury cars totaled 92,227 units.

Chevrolet March sales of 106,014 cars and trucks were the highest for any month since April, 1937, running 19 per cent ahead of March last year and 41 per cent above February, 1940. Chevrolet sales for the first quarter were 254,751, 33 per cent over the similar period of 1939.

Pontiac March deliveries were 49 per cent above March, 1939. The first quarter was the best in the company's history with a sales volume of 50,041 new cars, exceeding the previous record set in 1928. Buick's March sales were 17 per cent ahead of March, 1939, and 35 per cent greater than February this year. First quarter sales of 61,625 units set an all-time high.

Oldsmobile March sales were 31 per cent above March, 1939, while its first quarter output of 44,683 cars was the greatest in the company's history. Nash sales for March were 59 per cent ahead of February.

Retail sales of cars and trucks for the first two months of 1940, according to the A.M.A., were 35.7 per cent ahead of the same period of 1939, totaling 569,246 units for the two months.

AUTOMOTIVE MANUFACTURING ACTIVITY sought lower levels during the weeks ended March 23 and 30, passing through the unadjusted index levels of 250 and 245, respectively. The adjusted curve, which has been declining steadily since Jan. 13, passed through the points 267 and 262 during the weeks ended March 2 and March 9.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp. New York. 1926 = 100; [3] Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.

A Mathematical Consideration of the

By P. M. HELDT

THE ACTION of the fluid coupling is quite simple and does not call for any involved mathematics to explain it. An impeller and a runner are enclosed in a housing filled with a fluid. The impeller sets the fluid within its cells in motion, dashing it against the vanes of the runner, thereby producing a drag on the latter. In steady operation the runner turns at very nearly the same speed as the impeller. As the fluid in the coupling is always in motion, there is loss in the coupling as long as the impeller is turning. This loss, expressed in per cent of the power input, is equal to the ratio of the slip, that is, of the difference between the speeds of impeller and runner, to the speed of the impeller, also expressed on a percentage basis. In steady operation this loss is small; it is greater during periods of acceleration, and it amounts to 100 per cent when the impeller is turning and the runner is stationary. The torque on the runner is at all times equal to that impressed on the impeller by the source of power.

It is obvious that the fluid in the coupling has a dual motion. It is carried in circular paths around the axis of the coupling, in the cells of the impeller and runner, and it also flows in circuits in planes through the axis of the coupling. Motion of the fluid in planes passing through the axis of the coupling cannot produce any torque on the vanes of the runner, as that motion is parallel to these vanes. It is the motion of the fluid around the axis of the coupling (or in planes perpendicular to that axis) which produces a torque on the runner and permits of the transmission of power. The fluid enters the cells of the impeller near their inner edges, where its linear velocity around the axis of the coupling is low: and it leaves the cells near their outer edges, where its velocity is much higher. Owing to this increase in velocity, the fluid picks up kinetic energy while passing through the impeller, and it gives up this energy to the runner while passing through the cells of the latter, in which it is slowed down.

In Fig. 1 is shown a diagram of a fluid coupling of the type in which both the impeller and the runner form annular channels of semicircular cross section, which channels are divided into a considerable number of cells by radial partitions or vanes. While the sections of the two channels form a circle, motion of the fluid in planes through the axis of the coupling will not be around the center of this circle, for the reason that the cells are narrower, circumferentially, near the axis than farther away from it. If the flow is unrestrained by interior walls, the rate of flow will be the same from the impeller into the runner as in the opposite direction, hence the sectional area of flow in one direction will be the same everywhere. This enables us to determine the point in the section around which flow will take place.

Referring to Fig. 2, in which *ABCD* represents one of the cells of the runner in side view, if we disregard the thickness of the vanes—which will be practically negligible if the vanes are made of sheet metal—the width of the cells in the circumferential direction is in direct proportion to the distance from the axis. *AB* represents the inner edge of the cells, *CD* the outer edge, and *EF* the axis around which fluid circulation takes place. Let r_1 be the distance of the inner edge from the axis of the coupling; r_2, the distance of the outer edge from that axis, and r_3, the distance of the center of rotation of the fluid from that axis. Now

$$AB = cr_1,$$
$$CD = cr_2 \text{ and}$$
$$EF = cr_3,$$

where c is a constant. Fluid evidently flows into the runner over the quadrilateral *CDEF* and

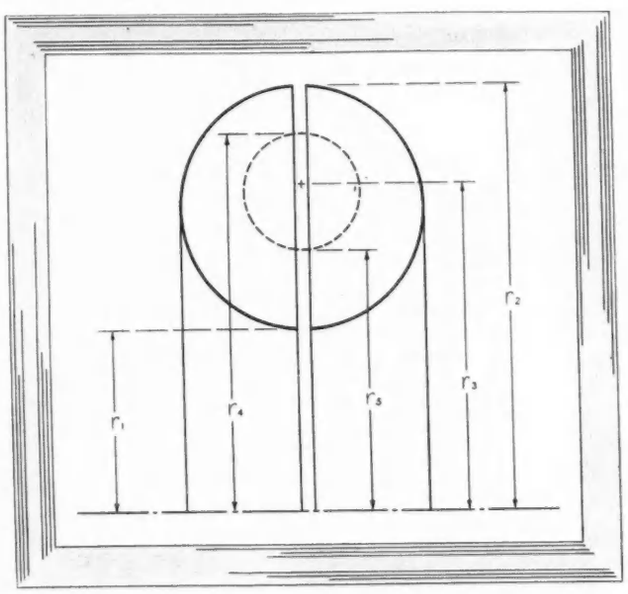


Figure 1

Fluid Coupling

out of it over the quadrilateral *EFAB*. These two areas must be equal; hence

$$\frac{cr_3 + cr_1}{2}(r_3 - r_1) = \frac{cr_2 + cr_3}{2}(r_2 - r_3)$$

which when solved gives

$$r_3 = \sqrt{\frac{r_1^2 + r_2^2}{2}}$$

This gives us the radius of the point in the sections of the coupling around which the fluid circulates.

The fluid passing through the impeller and runner follows widely different paths. Some flows along the outer wall in the cells of the impeller and runner and therefore undergoes a great change in velocity from the time it enters the impeller till the time it leaves the same, while some of the remaining fluid follows the very short path around the axis of circulation. In order to facilitate calculations of the power transmitted and other factors, it is desirable to determine what may be called the equivalent mean path of flow; that is, a path such that for the same rate of flow and the same speed of rotation it would produce the same torque and transmit the same horsepower as flow through the actual circuit.

Referring to Fig. 3, consider a small element of the stream entering a cell of the runner, of circumferential thickness dr and width $c\ r$, where c is a constant and r the distance of the element area from the axis of the coupling. The rate of flow evidently is proportional to the area, that is, to $r\ dr$. Now, the circumferential velocity of the fluid in this element is directly proportional to the distance from the axis and may be represented by $k\ r$, where k is a constant. The kinetic energy of the fluid passing per unit of time is proportional to the mass flowing per unit of time and to the square of the velocity of the fluid; that is,

$$dE = C\ r^3\ dr,$$

where C is a constant. The kinetic energy of the fluid entering the cell of the runner over its entire inlet area is found by integrating between the limits $r = r_3$ and $r = r_2$.

$$E = \int_{r_3}^{r_2} C\ r^3 dr = C\ \frac{r_2^4 - r_3^4}{4},$$

and the mean energy per unit of radial thickness of

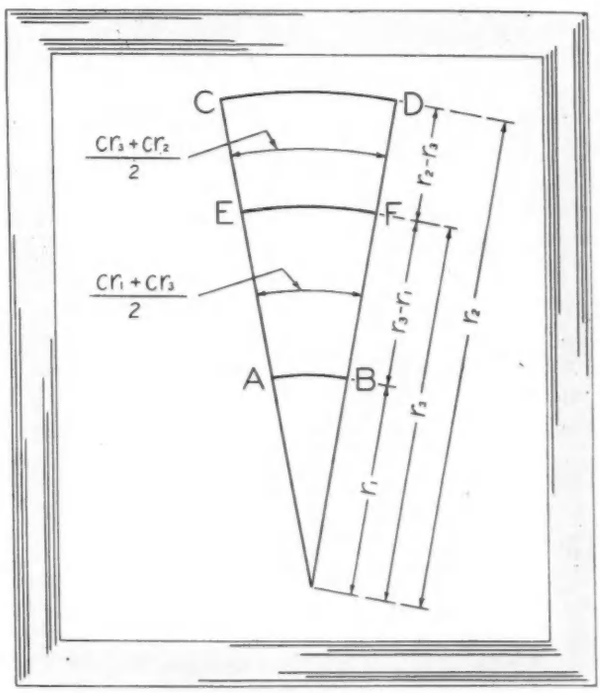


Figure 2

the stream is

$$e = C\ \frac{r_2^4 - r_3^4}{4\ (r_2 - r_3)}$$

Now suppose that fluid enters the cell only at a radius r_4 and that the kinetic energy per unit flow is the same as in the actual case. Since the kinetic energy in this case is $C\ r_4^3$ we have

$$C\ r_4^3 = C\ \frac{r_2^4 - r_3^4}{4(r_2 - r_3)}$$

which when solved gives

$$r_4 = \sqrt[3]{\frac{r_2^4 - r_3^4}{4\ (r_2 - r_3)}}\ \text{in.}$$

This equation gives us the equivalent mean radius of

inflow to the runner. In a similar manner we find the equivalent mean radius of outflow to be

$$r_5 = \sqrt[3]{\frac{r_3^4 - r_1^4}{4\,(r_3 - r_1)}} \text{ in.}$$

When a stream of fluid impinges against a solid surface, its velocity is changed, and the force of the reaction between the stream and the surface is equal to the product of the mass of fluid striking the surface per second, by the change in velocity imparted to the fluid, in ft. per sec.

The velocity of the fluid around the axis of the coupling at the equivalent mean radius of inflow, r_4, is

$$v_4 = \frac{N}{60} \times 2\pi \times \frac{r_4}{12} \text{ ft. per sec.}$$

and the velocity at the equivalent mean radius of outflow, r_5, is

$$v_5 = \frac{N}{60} \times 2\pi \times \frac{r_5}{12} \text{ ft. per sec.,}$$

hence the equivalent mean change in velocity of the fluid in passing through the runner is

$$v = \frac{N}{60} \times 2\pi \times \frac{(r_4 - r_5)}{12} \text{ ft. per sec.}$$

Here N is the speed of the runner in r.p.m. Consequently the pressure on the vanes due to a flow of 1 lb. per sec. is

$$\frac{1}{g} \times \frac{N}{60} \times 2\pi \times \frac{(r_4 - r_5)}{12} \text{ lb.}$$

This force on the vanes acts at a mean radius of $(r_4 + r_5)/2$ in. $= (r_4 + r_5)/24$ ft., hence the torque produced by the pressure on the vanes per pound of fluid entering the runner per second is

$$\frac{1}{g} \times \frac{N}{60} \times 2\pi \times \frac{(r_4 - r_5)}{12} \times \frac{(r_4 + r_5)}{24} \text{ lb-ft.}$$

$$= \frac{N(r_4^2 - r_5^2)}{88{,}450} \text{ lb-ft.,}$$

and if W lb. of fluid enters the runner per second, then the total torque on the runner is

$$T = \frac{WN(r_4^2 - r_5^2)}{88{,}450} \text{ lb-ft.}$$

The power transmitted by the coupling is

$$P = 2\pi NT/33{,}000 \text{ h.p.}$$

which is equal to

$$\frac{2\pi N}{33{,}000} \times \frac{WN(r_4^2 - r_5^2)}{88{,}450} = \frac{WN^2(r_4^2 - r_5^2)}{465{,}000{,}000} \text{ hp.}$$

Therefore, if the power transmitted and the speed of the runner are known, the rate of circulation of the fluid in the coupling can be found from the equation

$$W = \frac{465{,}000{,}000\,P}{N^2(r_4^2 - r_5^2)} \text{ lb. per sec.}$$

Since the annular channel of the fluid coupling

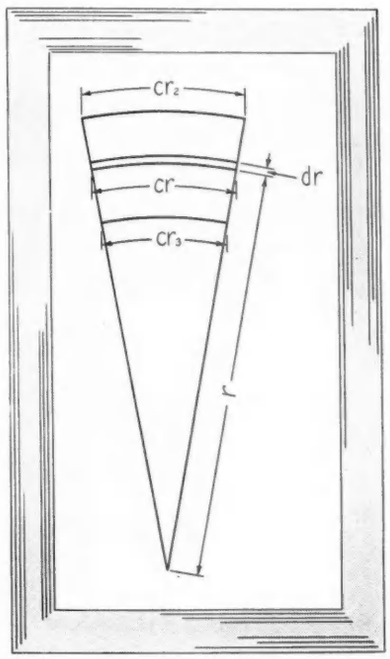


Figure 3

which contains the active fluid has an inner radius r_1 and an outer radius r_2 in., its volume is

$$(r_2 - r_1)\,\frac{2\pi}{4} \times \frac{(r_2 + r_1)}{2} \times 2\pi$$

$$= \frac{\pi^2}{4}(r_2^3 + r_1^3 - r_2r_1^2 - r_1r_2^2) \text{ cu. in.,}$$

and if we allow 10 per cent for the volume occupied by the vanes, the effective volume of fluid in circulation is

$$2.22\,(r_2^3 + r_1^3 - r_2r_1^2 - r_1r_2^2) \text{ cu. in.}$$

Now let us assume that r_1 is equal to 3 in. and r_2 to 7 in. Then the effective volume of fluid is

$$2.22(7^3 + 3^3 - 7 \times 3 \times 3 - 3 \times 7 \times 7) = 355 \text{ cu. in.,}$$

and if the fluid used in the coupling has a specific gravity of 0.8, this volume weighs

$$\frac{355 \times 8.2 \times 0.8}{231} = 10 \text{ lb.}$$

The circular line around which the fluid will flow has a radius

$$r_3 = \sqrt{\frac{3^2 + 7^2}{2}} = 5.385 \text{ in.}$$

The equivalent mean radius of inflow into the runner is

$$r_4 = \sqrt[3]{\frac{7^4 - 5.385^4}{4\,(7 - 5.385)}} = 6.23 \text{ in.}$$

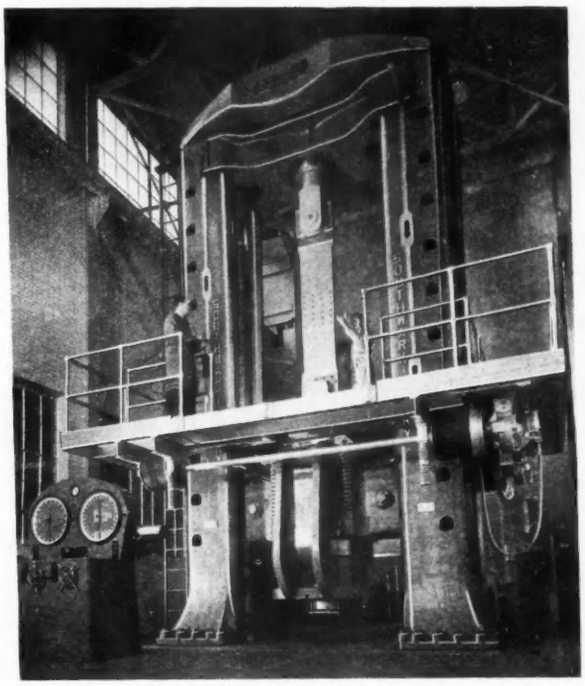
and the equivalent mean radius of outflow

$$r_5 = \sqrt{\frac{5.385^4 - 3^4}{4\,(5.385 - 3)}} = 4.30 \text{ in.}$$

Now suppose the coupling has to transmit 125 hp.

(*Turn to page* 384, *please*)

Mammoth Testing Machine Installed



A NEW mammoth materials-testing machine, claimed to be the world's most powerful, was demonstrated on Saturday, March 2, at the Laboratory of the Aluminum Corporation of America, New Kensington, Pa., before an assembly of testing engineers, Government officials, Army and Navy officers, and industrialists. This machine, built to designs of R. L. Templin, chief engineer of tests of the Aluminum Company of America, is capable of exerting a force of 3,000,000 lb. in compression and 1,000,000 lb. in tension. While it is not the largest machine of its kind, it is the most powerful, in that it can exert these forces while the head or ram is moving at a velocity of 3 ft. per min. At a social function held in the evening of the same day at the Long Vue Country Club, Mr. Templin was awarded the Longstreth medal of the Franklin Institute for the development of this machine, by Dr. James Barnes of the Institute.

The decision to have the machine built was made by officials of the Aluminum company in December, 1938. The largest materials-testing machine in the laboratory up to that time had a capacity of 300,000 lb., which was not sufficient for a new research program contemplated by Templin's staff. The new machine, which was built by the Baldwin-Southwark Corporation in Philadelphia, was designed as an aid in improving aluminum products. In its design, special consideration was given to adaptability, manipulatory features, and means for measuring and recording loads. It is essentially a 1500-ton precision metal-working machine, modified in certain details of design and provided with a powerplant of sufficient size to permit of high-speed operation at full capacity.

The machine can be operated as an extrusion, forging, or forming press. In addition, it is provided with auxiliary equipment which will permit of a study of the relationships existing between the various forces involved in the plastic flow of aluminum through a wide range of conditions.

The overall height of the machine is 40 ft. 4 in., of which 25 ft. is above the floor line, the rest below. It is 16 ft. 4 in. wide and 9 ft. from front to back. In compression testing, 90 in. space is available from right to left, and 108 in. from front to back, with a maximum height of 186 in. In tension testing, a similar space is available from left to right, with a maximum height of 150 in. plus 36-in. stroke. The main ram is 46 in. in diameter and has a 36-in. stroke. The pullback rams are 12 in. in diameter. While the hydraulic stroke has a maximum range of 36 in., the heads of the machine can be adjusted over the full height by means of a 50-hp. motor. In other words, if an adjustment is to be made in excess of 36 in., it is done by the motor rather than by the hydraulic equipment. The motor operates the screws on both sides of the machine to bring the head into the desired position.

For testing large structural specimens, a pump delivering 18 gals. of oil per minute is driven by a 20-hp. motor. A 300-hp. motor is needed for high-speed testing, when 270 gals. per min. is delivered. In both cases the oil is under a pressure of 1800 lb. per sq. in.

A load of 3,000,000 lb. can be weighed on the machine with an error of less than 2 lb. in thousand, it is said, yet the sensitivity of the machine is such that the weight of a man moves the point of the indicator hand nearly ¼ in. in the low range. The high speed of 36 in. per min. is one of the most interesting features of the machine, as it gives such a loading rate that the yield point of a given specimen is passed in less than one second, and the specimen fails in less than 15 sec.

At the demonstration, an assembly of aluminum plates held together by aluminum rivets was pulled apart, failure occurring at 580,000 lb. The design was such that the specimen failed by shearing of the rivets. Another demonstration consisted in cold-forging a 6-by-6-in. aluminum billet down to a section of 1-by-1-in. In the actual study of plastic-flow properties of aluminum the specimen will be heated.

The get-together in the evening was presided over by S. K. Colby, vice-president in charge of research. Short addresses were made by President Roy A. Hunt of the Aluminum Company of America, and R. L. Templin, chief engineer of tests, and longer addresses by Dr. F. C. Frary, director of research, and Dr. James Barnes, of the Franklin Institute.

New Developments in AUTOMOTIVE

PAPERS covering a variety of topics related to the general subject of new materials in transportation brought to light much fundamental information and historical background at the Detroit Spring Meeting of the American Society for Testing Materials. An important contribution in the field of metallurgy was the paper "Selection and Application of Automotive Steels" prepared jointly by A. L. Boegehold,[1] W. H. Graves[2] and E. W. Upham.[3] Messrs. Boegehold, Graves and Upham observe that present day trends in the use of steel for automobile parts have been influenced by a number of factors, such as the advance in heat treating equipment and methods of treating, the development of experimental testing in engineering departments to prove materials and treatments—facilitating the selection of steel, improved quality and uniformity of steel resulting from grain size and hardenability testing, increased knowledge of how fatigue failures occur, and open mindedness on past customs and practices.

The authors illustrate the way manufacturing methods and physical property requirements determine what price steel must be used for different motor vehicle parts by describing the process of arriving at a decision in several specific instances. Inasmuch as there is insufficient space here to present all of the examples given, the details of only one—the piston pin—can be included.

A piston pin must be sufficiently strong and ductile and resist wear. Most passenger cars use carbon steels selected from one of the seven SAE steels listed herewith in a chart giving the machinability and cost rating of these steels.

Selection of a steel from this list is dependent on hardenability, steel costs, and machining costs. Each of three of the lightest steels now in use—X-1020, 1115, and X-1314—falls in a different price and machining class. The X-1020 is the lowest price and poorest machining. X-1314 is the highest price and best machining, while 1115 is about half way between the two for both price and machinability. The hardenability of these three steels will vary with different steel manufacturing processes, but for the same process the higher the manganese the better the hardenability, therefore X-1314 should be the easiest to harden, with 1115 and X-1020 the same. Thus the choice between 1115 and X-1020 must be based only on machinability and cost of the steel, while X-1314 is based on these considerations along with hardenability. The difference in cost per automobile between 1115 and X-1020 is about ¾ cent. The drilling cost of piston pins is the main consideration and this varies with equipment available, amount of production, and accounting practice as to allocation of overhead costs, so the balance between machining costs and steel costs must be left with the individual plant.

Machinability and Cost Ratings of S A E Steels

	Cost Rating % (A) Cold Finished	Machinability Rating % (B)	Manganese Content % (C)
1015	100	50 – 65	.30 – .60
1020	100	50 – 65	.30 – .60
X-1020	100	50 – 65	.70 – 1.00
1115	104	70 – 75	.70 – 1.00
1120	104	70 – 75	.60 – .90
X-1314	107	90 – 95	1.00 – 1.30
X-1315	107	90 – 95	1.30 – 1.60

(A) Commercial price lists—September 1939
(B) Metals Handbook—1939, p. 899
(C) SAE Handbook—1939

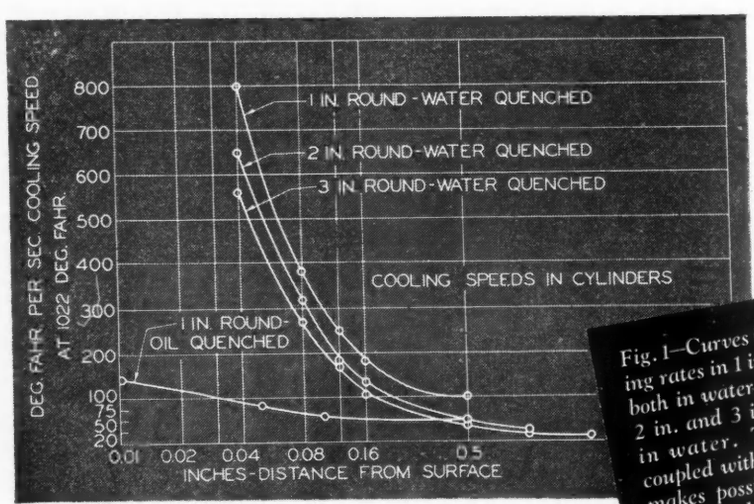


Fig. 1—Curves indicating the cooling rates in 1 in. rounds quenched both in water and in oil and also 2 in. and 3 in. rounds quenched in water. This information, coupled with hardenability data, makes possible the prediction of what hardness to expect at any point in a bar made of any steel.

[1] General Motors Corp.
[2] Packard Motor Car Co.
[3] Chrysler Corp.

MATERIALS . . .

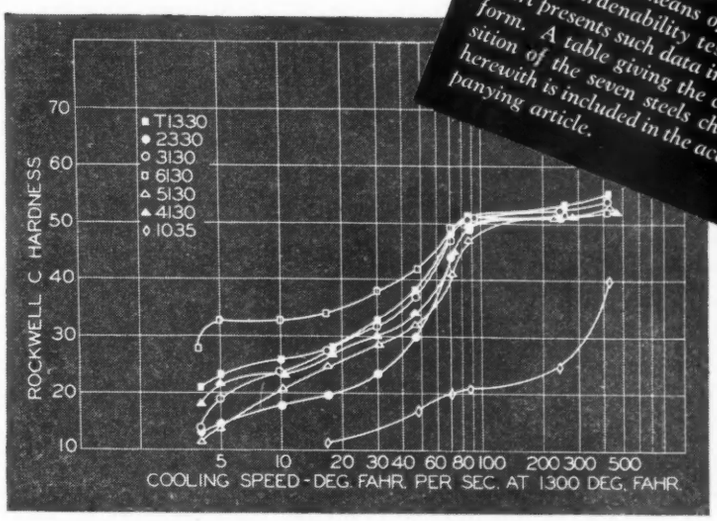


Fig. 2—Hardness obtainable in various steels throughout a range of quenching speeds is easily determined by means of any accepted hardenability test. This chart presents such data in a new form. A table giving the composition of the seven steels charted herewith is included in the accompanying article.

The additional cost of X-1314 over 1115 is again about ¾ cent per car, so that the foregoing calculations plus the better hardenability of this steel as it affects heat treating costs must be considered. This again must be left to the individual plant.

Steels 1015 and 1020 must be inspected for hardenability in the carburized condition when to be used for piston pins because, being low in manganese, these steels may be lacking in this property. X-1315, on the other hand, should make a good pin, cheaply processed. Its principal application would be in a pin of heavier section which, because of slower cooling rate in quenching, would require more core hardenability in order to obtain the required core properties.

One large manufacturer uses tubing instead of bar stocks as used by all others for piston pins. Steel tubing costs more per piece than does bar stock; on the other hand, the drilling cost is eliminated. Piston pins when carburized should have little, if any, case on the inside surface because they are generally of such thin wall and so poorly finished that failure in service will result from notch effect, thus when tubing is used or bar stock pins are drilled previous to carburizing, some prevention of carbon penetration on the inside must be provided and this is an additional expense which must be taken into consideration.

For scientific selection of steels from the standpoint of hardenability two sets of data are needed. One set must include the hardness obtainable in all steels at any cooling speed ordinarily encountered in quenching. The other set of data will show what cooling speeds occur in the parts during quenching. With this information, it would be possible to predict the hardness in any part made from any steel, thus enabling selection of the steel most suited, assuming a knowledge of what hardness the part should be.

The technique of making cooling rate determinations is not difficult and with experience will be regarded as no more troublesome than numerous routine tests, such as grain size determinations and hardenability tests. The literature contains some information presented by French and Klopsch[4] and by Scott[5] on simple shapes such as round bars, spheres, and plates. Information provided by Scott has been plotted in a modified arrangement in Fig. 1. The curves in Fig. 1 indicate the cooling rates in 1 in. rounds quenched both in water and in oil and also 2 in. and 3 in. rounds quenched in water. This information, coupled with hardenability data, makes it possible to predict what hardness to expect at any point in a bar made of any steel. For example, a steel requiring a quenching speed of 100 deg. Fahr. per second to harden would harden to a depth of .030 in. in a 1-in. round oil quenched; or to the center of a 1 in. round water quenched; to a depth of .220 in a 2 in. round water quenched, and to a depth of .17 in. in a 3 in. round water quenched. What is more, the hardness at points cooled at less than the speed required to harden may be predicted with the information obtained from any hardenability test which tells hardness produced

[4] H. J. French and Klopsch—The Quenching of Steels, by H. J. French, A.S.M., 1930.

[5] Scott—A.S.M., Vol. 22, 1934, p. 68.

by various cooling rates. Similar knowledge of cooling rates during quenching automobile parts would make it possible to predict as quenched hardness at any point in the part. This information, the authors point out, is at present lacking and should be determined in the same way cooling speeds were determined in the simple shape to which Fig. 1 is devoted. The hardness obtainable in the various steels throughout a range of quenching speeds is easily determined by means of any accepted hardenability test. This data has been secured on a number of alloy and carbon steels and is presented in a new form in a number of charts contained in the paper of which Fig. 2 is an example.

The compositions of the seven steels charted in Fig. 2 are as follows:

Composition of Steels Charted in Fig. 2

Symbol	C	Mn	Si	Mo	Ni	Cr	V	Grain Size
T-1330	.34	1.62	.24	....	....	....	....	6 - 8
2330	.30	.69	.24	....	3.47	....	....	6
3130	.31	.62	.21	....	1.23	.62	....	6
6130	.33	.70	.23	....	....	1.10	.22	6 - 8
5130	.30	.74	.20	....	....	.87	....	6 - 8
4130	.30	.70	.23	.19	....	.69	....	6
1035	.38	.86	....	....	....	....	....	Fine

It is emphasized that the information in these charts represents a mere beginning of the work that must be done to obtain the information needed, to show the limits of hardness at each quenching speed for each SAE specification composition range. Variation in hardenability in heats of the same SAE specification will be caused not only by variation in composition but by variation in the method of making the steel, by varying hardening temperature and the heat treatment prior to hardening. In fact, the possible variation in hardenability for any one specification range of composition will be greater than could be permitted for any given part, therefore, steel will have to be specified; principally, according to hardenability limits, and only approximately as to composition limits. The specification of hardenability limits will result eventually in widening the allowable composition limits. It is pointed out that the curves for hardenability in Fig. 2 and other charts of the type contained in the paper do not represent accurately the relative hardenability of these steels because each curve represents only one heat of steel.

The authors express the belief that metallurgists in the near future will see the advantage of referring to steels in terms of hardness produced at various quenching speeds, and to parts to be heat treated in terms of cooling speeds. This means of classifying steels could become so useful, they say, that metallurgists who are responsible for selection and treatment of automotive steels would acquire the habit of remembering the cooling rates of different automobile parts and what hardnesses in various steels will be caused by those cooling rates. Such procedure, it is argued, would eventually work toward more efficient use of alloys in steels and would cause revision of the composition ranges in alloy steels now in favor.

Finally, the authors observe that apparently the next important step in the intelligent selection of steels for automotive parts will be a comprehensive cataloging of hardness at various cooling speeds for all steels and of cooling speeds of all manner of structural parts to be hardened. Furnished with such information, they conclude, the metallurgist will be able to specify hardenability limits for steels compatible with the cooling rate of the parts for which the steel is prescribed.

Exhaust Valve Materials

A historical review of past and present practice in exhaust valve materials, prepared by S. D. Heron, O. E. Harder* and R. M. Nestor*, was presented at the ASTM meeting by Mr. Heron of the Ethyl Gasoline Corp. The authors discussed the commonly used laboratory and engine test methods for valve exhaust materials and pointed out that no combination of laboratory tests will predict adequately the behavior of valve material in actual service. V. C. Young, chief engineer, Wilcox-Rich, entered a vigorous objection to the viewpoint expressed in the paper that the limitations of exhaust valves are responsible for retarding progress in engine design. He pointed out that engine design elements enter the picture most prominently and have direct bearing upon the selection of valve materials, design of valves, and their service life.

Rubber

Dr. Sidney M. Cadwell, director, automotive development, United States Rubber Co., intimated in his paper "Rubber of Tomorrow" that all previous conceptions of the mechanical properties of rubber would have to be revised in accordance with existing knowledge. For example, the most valuable mechanical properties, so far as strength and resistance to fatigue failure are concerned, can be realized only when the material is suitably pre-loaded in the initial "no-load" condition. Thus, rubber in tension gives the longest life when initially extended about 200 per cent, the same qualitative pre-loading to be imposed on rubber used in compression or sheer.

Dr. Cadwell pictured a bright future for synthetic rubber-replacing materials, such as Neoprene and Thiokol, expressing his belief that these materials will find increasingly wider application. He made reference, too, to cellular rubber made by recently developed production processes. While the scope of applications for this type of rubber are unplumbed at the moment, he mentioned that its best properties are those of thermal and acoustic insulation coupled with excellent shock resistance qualities.

Lubricants

In the matter of new developments in engine lubrication, J. P. Stewart, R. C. Moran, and C. M. Reiff, all of Socony-Vacuum, presented the results of recent studies, indicating the desirable features of certain additives. It was shown that the proper additives serve to stabilize the lubricant and produce a marked degree of freedom from corrosion, varnish, sludge, and

* Battelle Memorial Institute.

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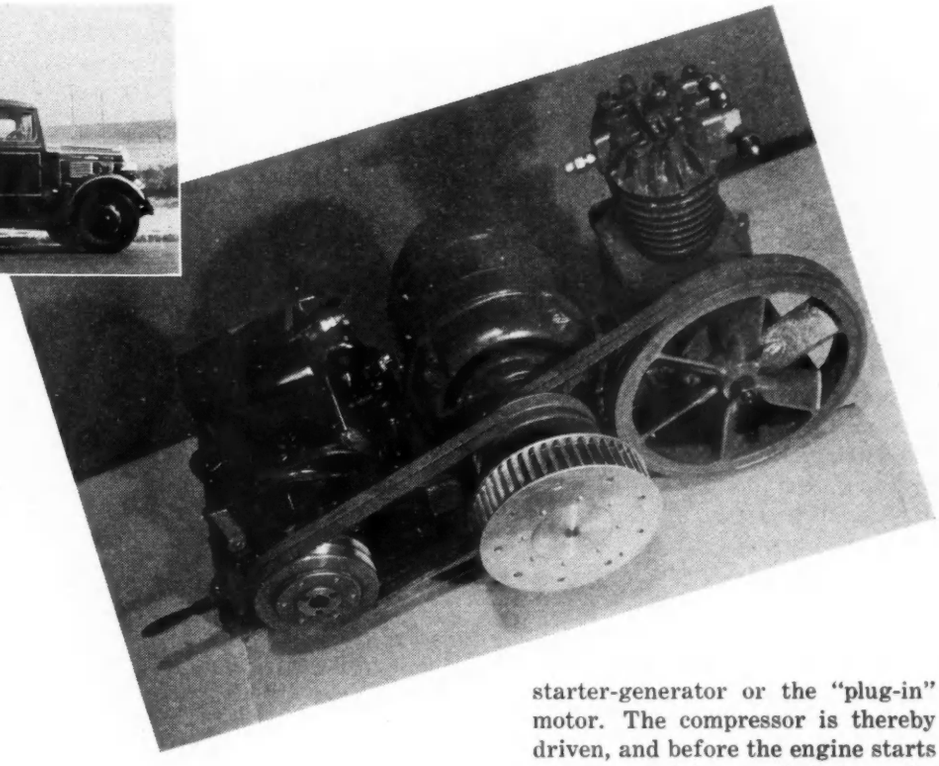


Mobile Refrigerating system with dual drive. The compressor at the left can be driven by either the "plug-in" electric motor in the center or the propane (gas) engine at the right. Demonstration truck showing refrigerator unit installed.

Mobile Refrigeration Units for Trucks

A SELF-CONTAINED refrigerating system for installation in motor trucks for the transportation of perishable or frozen foods is being offered by Mobile Refrigeration, Inc., of New York. The unit, which comprises a compressor and a small gas engine for driving it, a condenser and a supply tank, can be equipped with a 6-volt starter-generator, so that it can be started by merely pressing a button. Alternately it can be furnished with what is referred to as a dual drive, in which case, in addition to the gas engine, there is a 110- or 220-volt electric motor which can be plugged into the mains in the garage. This motor can be used to start the engine previous to starting out from the garage, and also for driving the compressor when in the garage. Propane is used as the engine fuel and also as the refrigerant.

When the system is being operated by the 5-hp. engine, the refrigerating cycle is said to be open. The engine constantly draws its supply of fuel from the system, and propane is constantly replaced in the system from a supply tank. The system then is said to work on an open cycle. There is only about one quart of propane in the system at any time. When operating on the open cycle small leaks of propane do not interfere with the refrigeration (as in the case of certain other systems) for the reason that propane is being supplied to the system at the same rate as that at which it is lost (to the engine and elsewhere). In starting the system, the engine is cranked by the starter-generator or the "plug-in" motor. The compressor is thereby driven, and before the engine starts the air must be expelled from the system, which generally takes about 30 sec.

When the "plug-in" motor supplies the power, operation is on the closed cycle, the supply tank being shut off during the starting operation by valves controlled by two solenoids. In a demonstrating truck, the unit, which measures 44 by 22 by 22 in., is carried at the side of the truck in the place of the usual side-mounted fuel tank, enclosed in a metal box. Propane is carried in two bottles hung on the opposite side. Bottles can be changed while the system is in operation.

The largest model, which is suitable for large trucks and trailers, weighs about 650 lb. It incorporates a 5-hp. Briggs & Stratton engine and a Brunner compressor. The electric motor of the dual-drive model is of Westinghouse make, while the starter-generator of the other model is a Leece-Neville. Experience with the demonstrating unit is said to have shown that the consumption of liquefied gas is at the rate of about 1 lb. per hour of operation, the cost of the fuel being less than 5 cents per lb.

This refrigerating system is the invention of Dr. Peter Schlumbohm of New York, and is covered by a number of patents that are controlled by the Propane Development Corp. of New York.

Not only the belligerent European nations but also the adjoining small neutral states are suffering from a shortage of motor fuel. In Greece (so we learn from an Italian source) the government has decreed that vehicles in public service shall be operated only every other day, whereas in Bulgaria it has been decided to provide a considerable number of motor buses with gas generators.

Valuation and Tests of

By FRITZ LICHTENBERGER*

Most investigations on combustion engines bear upon the variation of the cylinder pressure with time or crank angle (p-t diagram) or with piston travel (p-V diagram or energy diagram). Cylinder pressures are recorded by means of indicators which, in spite of their long development period—the first one was built by James Watt toward the end of the eighteenth century—still do not meet all legitimate requirements. The reason for this is the rapid development of automobile and (especially) aircraft engines, which, during the past several years, has greatly raised the requirements made of engine indicators, with the result that there has been an urgent need for improvement. As the deficiencies of indicators are widely known, many suggestions for improvements are being made, and new designs are being offered constantly. In connection with some of these new instruments, claims of an absolute lack of inertia and of other ideal characteristics are being made. With the object of clearing up some of the uncertainties thus created, it is intended to here summarize the features on the basis of which an engine indicator should be judged; and it is also proposed to suggest test methods by which quantitative investigations with respect to these features are made possible. Owing to the direction which indicator development has taken, the following discussion refers particularly to the piezo-electric (quartz) type of indicator, but to a large extent it applies also to other indicators, with the exception of the stroboscopic type.

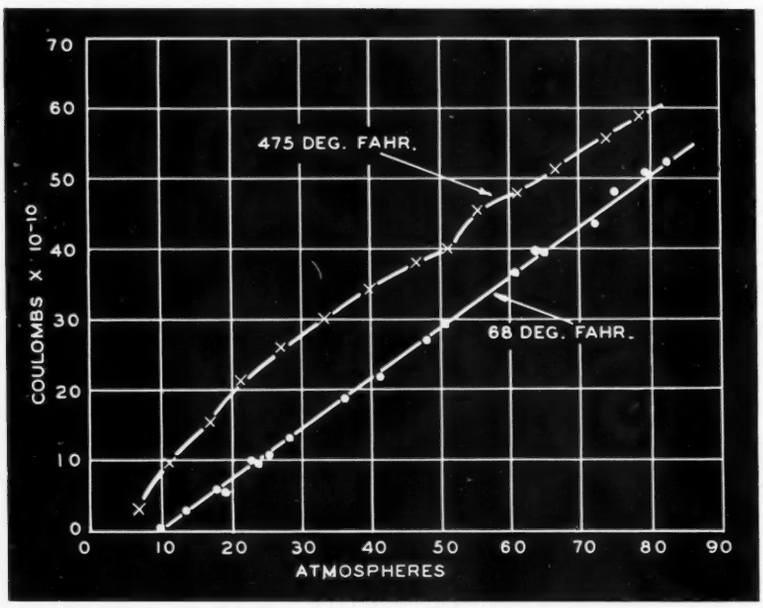


Fig. 1—Check for "linearity" of indicator without water cooling.

THREADED CONNECTION—As the indicator generally is screwed into a spark-plug hole, its permissible dimensions are limited first of all by the dimensions of standard spark-plug threads. The usual spark-plug threads are 18 x 1.5 mm., 14 x 1.25 mm., and 12 x 1.25 mm.; in addition there are spark plugs with 10 x 1.0 and 6 x 0.75 mm. threads. As with most indicators it is quite difficult to come down to a 12-mm. (½ in.) diameter, it is not likely that indicators with 10 and 6 mm. thread diameter have been built in quantities so far. It would, of course, be possible to use reducing nipples or adapters for the smaller spark-plug threads, and long indicator bores. However, every effort should be made to bring the pressure-sensitive element of the indicator as close to the combustion chamber as possible, as otherwise distorting or damping influencs make themselves felt. True, Beale and Stansfield succeeded in so designing an indicator connection that complicated bores and intermediate chambers permitted of obtaining accurate diagrams in spite of considerable distances between the diaphragm and the combustion chamber. But unless compensation is provided in this manner, it is well to avoid extensions, because they tend to falsify the pressure curve. Experimental investigations of errors in the diagram due to this cause are discussed by De-Juhasz and Geiger in their book on "The Indicator," and also by Meurer. The influence of the air passage will vary with its proportions. In the case of wide passages with little resistance, vibrations of the air column are excited by sudden pressure changes. and the natural frequency of the air column is particularly evident. In this connection it may be pointed out that the calculated frequency of the air column may be seriously affected by other parts, and the resulting pressure fluctuations are superimposed on the diagram as higher harmonics. In the case of narrow passages with considerable resistance, the natural vibration of the air column is suppressed by damping forces, but the

* Translation of a Report of the German Experimental Institute for Aviation (DVL).

Electrical Engine-Indicators

same damping forces also reduce the pressure peaks and moderate any steep pressure gradients. In any event, the time consumed by the pressure wave in traveling from the surface of the combustion chamber through the passage to the indicator has a notable effect. When the damping is light, the resulting phase difference can be calculated in a simple manner from the velocity of sound, but where there are large damping forces the lag increases beyond its theoretical value, and in consequence of the lag of the diagram with respect to other recorded phenomena (dead-center point, ignition point) distortions may be caused. At room temperature a passage of 1 3/16 in. length, for instance, results in a time lag or shifting of phase of 0.0001 sec.

Therefore, if in certain special cases the use of a long passage cannot be avoided, it is necessary to at least give theoretical consideration to the question as to whether serious errors may be introduced in the diagram thereby; and if possible, practical experiments should be conducted to determine the influence of the passage on the diagram. Moreover, such a passage produces a dead space which changes the compression ratio. Even though spark plugs contain a dead space, of about 0.06 cu. in. as a rule, in the indicator it is desirable to have a completely plane and smooth closure, because this tends to prevent incrustation. In addition, indicators with a plane closure can be used also for certain special purposes, such as measurement of the dynamic pressures of jets, etc.

SIZE AND WEIGHT—An indicator designed to go into a small spark-plug hole, say 12 mm., but which further up has a diameter of 2 in., cannot be regarded as of good design. Aside from the appearance question, a large and heavy indicator always will be more sensitive to shocks than a small one, which latter can take part in the vibrations of the engine without severe reactions. However, a compelling reason for keeping down the dimensions of the indicator as much as possible is furnished by the restricted space conditions on most aircraft and automobile engines. It is quite a trick to put an indicator in place between the cooling fins and the intake and exhaust manifolds of air-cooled engines. The ideal for the dimensions of the indicator is furnished by the spark plug which it is to replace. There are a number of quartz indicators which conform to the dimensions of the 18 mm. spark plug, but probably it will be some time before indicators of attractive appearance are available that can be inserted into a 12 mm. spark-plug hole.

INDICATING RANGE—An important specification of any indicator is that of its indicating range, and this holds especially in the case of indicators other than those of the piezo-electric type, which usually have a quite limited range. The indications of the piezo-electric indicator can be reduced at will by the insertion of condensers, and the real ideal is a robust design which permits of indicating small pressures by the use of suitable amplification. That this possibility has not been fully explored is indicated by the existence of a number of piezo-electric low-pressure indicators. If it is desired to be able to record fuel pressures of the order of some hundred atmospheres, and also minimum pressures of one-hundredth atmosphere, the pressure range to be covered is 1:10,000, and this is rather difficult to accomplish with one and the same instrument. In most cases it will be possible to build even quartz indicators for only a limited pressure range. It must be remembered in this connection that very sensitive indicators naturally are less able to withstand high pressures and temperatures; besides, they are more sensitive to shock, which probably is accounted for by their larger pressure areas.

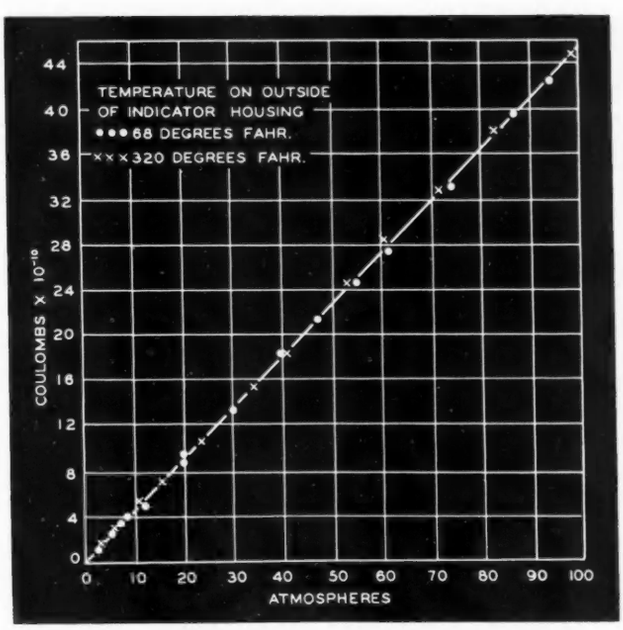


Fig. 2—Sensitivity curve of the DVL piston-spring indicator with 12x1.25 mm. thread.

COOLING — The thermal stresses to which indicators are subjected are unusually high when they are used on air-cooled engines, and even though these stresses may not reduce the life of the indicator, they will reduce its accuracy, for which reason water cooling is being used to a certain extent. But with air-cooled engines, which themselves have no water-cooling system, water cooling of the in-

dicator involves considerable difficulty on the test stand. The cooling connections are easily torn off, and in such a case if, after the indicator has been destroyed, water should get into the combustion chamber, even the engine would be endangered. Investigations at the VDL have shown that if the indicator is able to withstand the thermal stress, water-cooling is unnecessary, for if the quartz system is skillfully arranged the change of the calibration constant due to the rise in temperature may be held negligibly small. An important item is the maximum temperature which the indicator will withstand if the cooling system should fail.

LIFE—As applied to engine indicators, robustness is a very relative concept. There is an enormous difference between the stresses to which the instrument is subjected when used on small water-cooled automobile engines and when used on the newer air-cooled aircraft engines, especially when the latter are detonating. This is due to the extreme utilization of materials in modern aircraft engines. A physically defined test to simulate these conditions is very hard to evolve, because in service the instrument is subjected to a super-position of thermal, static and dynamic stresses. The simplest test consists in installing the instrument on a particular engine, which is then operated under specified conditions until the instrument shows signs of destruction or of alteration. The most severe test is in an air-cooled, high-specific-output, knocking engine. At the VDL the BMW 132 single-cylinder engine has been successfully used for the purpose, and good indicators operate on it for more than 50 hours under conditions of engine detonation. The conditions of operation are as follows: Fuel, chiefly aviation gasoline of 87 octane; spark advance, 28 deg.; compression ratio, 6.5; air-excess ratio, 0.9; charging pressure, variable, up to 1.9 atmospheres; speed, 1600 r.p.m.; temperature of charging air, up to 266 deg. Fahr.

This method, of course, is very expensive, unless by chance the indicator test can be combined with some other investigation, and it is not at all impossible that instead of the indicator, the engine will fail first. Nevertheless, it should be emphasized once more that an indicator which may have survived several hundred hours on a water-cooled automobile engine cannot for that reason be designated a robust one. To deserve this designation it must have withstood a 50-hour test on a knocking aircraft engine, at least under present conditions.

All engine data (fuel, octane number, compression ratio, etc.), should be given accurately, as concepts of the nature of knocking differ so widely. It has been suggested by F. Seeber and the author that knock intensity could be defined by the second differential coefficient of the variation of pressure with time, and that atmospheres per second^2 could be used as an absolute physical measure of the intensity of knock. But as this measurement would necessitate the use of special apparatus, this intrinsically better method is merely referred to here. Minor overload tests with respect to pressure and temperature can be carried out in conjunction with the method of calibration described further on.

CALIBRATION—Manufacturers of scientific instruments customarily furnish the calibration constant, or at least a calibration curve, with all instruments supplied by them, but this really natural procedure has not yet been adopted in connection with electrical indicators. One reason for this is that the calibration of quartz indicators is not a simple matter; another, that the calibration constant is subject to certain changes which may be produced by heating, heavy shocks, or overloads. Finally, the calibration constants of a given production lot of quartz indicators are by no means all alike, owing to differences in contact between large ground surfaces. As has been shown by Meurer, the spring rate of two ground surfaces (steel and quartz) of 0.315 in. diameter is equal to 5,000,000 lb. per in.; that is, it is the same as that of a quartz column of the same diameter and 0.19 in. long. Now, since the spring rate of the initial-pressure member enters directly into the calibration constant, it becomes obvious that the latter depends on the quality of the contact surfaces. Conditions are no better in the case of indicators of other types, such as those embodying stacks of carbon disks; on the contrary, the calibration constants of such indicators can be easily changed by overloading. When a carbon-stack indicator was investigated at the DVL, it was found that the total resistance was increased from 5.7 to 7.9 ohms by a knock or hammerblow produced for testing purposes.

For the above reasons, at the present time, the buyer of an electric indicator, if he wants to be able to get fairly accurate results, is obliged to acquire also a calibrating apparatus. The absolute magnitude of the sensitivity of modern quartz indicators ranges between 1 and 0.05 x 10^{-10} coulomb per atmosphere. In comparison, the theoretical discharge of two quartz blocks connected in series, with a surface of 0.155 sq. in., is 0.20 x 10^{-10} coulomb per lb.

CALIBRATION AT ROOM TEMPERATURE—For many purposes, and especially for a check of the "linearity," calibration at room temperature suffices. Good results have been obtained in this connection from the oil-pressure presses built by some firms for the calibration of pressure gages. There are two different types. In one the oil pressure is produced by a piston with a threaded spindle, and the pressure is read off on a built-in precision pressure gage or manometer; in the other, the piston with threaded spindle serves only to fill the press with oil, and is then cut off by means of a valve. In this case the oil pressure is produced by a second, vertical piston, on which weights are placed. The friction of this piston can be reduced to a minimum by rotation, so that very accurate pressure determinations can be made. The first construction (with the manometer) has the advantage of greater simplicity.

As already mentioned, the "cold" calibration serves the purposes of determining the "linearity." Owing to the complicated power flow, many indicators, in contrast to what would be expected theoretically, have a non-linear calibration characteristic, which renders the evaluation of indicator diagrams more difficult. Further along, reference will be made to the non-linearity of the amplifier coupled to the instrument. Of course, even a non-linear indicator can be used

directly if the diagram is redrawn and corrected with the aid of the calibration curve. However, a good indicator should give linear indications, that is to say, linear within the same limits which can be maintained in other respects. Experience has shown that an accuracy of ±2 per cent is sufficient for most purposes. This figure corresponds to the accuracy which can be maintained with quartz indicators without special arrangements. Where greater accuracy is called for with quartz indicators, unless precision instruments are used, special care must be given to the insulation of the input circuit of the amplifier to which it is connected. Use must be made only of electrometer tubes[1] of the highest possible input resistance (and, unfortunately, correspondingly low amplification), and the entire input circuit must be protected against moisture and cleaned repeatedly. In addition, attention must be given to the phase shift of the amplifier to which the indicator is connected; that is to say, the characteristic of the amplifier must be taken repeatedly and its change with respect to time must be determined[2].

The "cold" calibration may bring out additional errors of the indicator. For instance, there are indicators whose calibration is changed by screwing them into the cylinder. In that case, if the instrument is screwed in place repeatedly, one obtains calibration curves of different sensitivity, or the indicator gives a discharge only at higher pressures. The calibration curve of an indicator of this kind is shown in Fig. 1. That the error was caused by screwing in of the indicator was proven by the fact that when weights were placed on the diaphragm of the indicator outside the oil press, its behavior was quite normal. Serviceable diagrams cannot be taken with such an indicator.

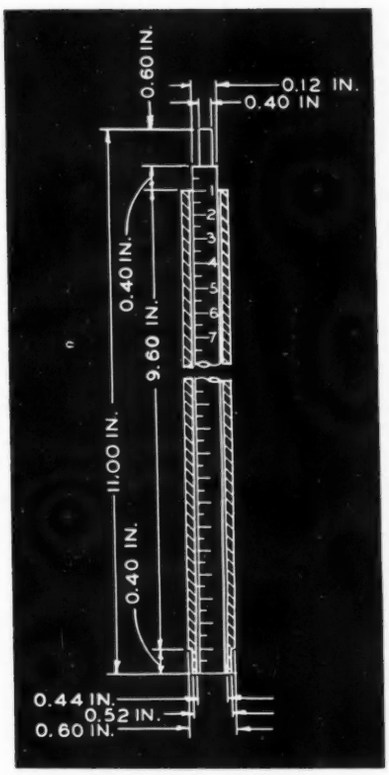


Fig. 3—Drop bar.

HOT CALIBRATION—In the engine the indicator is subjected to additional stresses due to the rise of temperature. The endurance test has been discussed already, and we will deal here only with the change in the calibration constant due to the rise in temperature. From this point of view, also, the quartz indicator deserves preference, because as compared with other effects, such as those on magnetism, electric resistance, etc., the effect of temperature on the piezo-electric phenomenon is relatively small. According to A. Andreef, V. Freedericksz and J. Kazarnowsky, the piezo effect of quartz when its temperature is raised 27 deg. Fahr., to 544 deg. Fahr., changes only by 4 per cent. S. Meurer found a loss of 3 per cent up to 390 deg. Fahr. If quartz indicators, nevertheless, show considerable errors when heated, this is due to the change in the initial pressure caused by the heat expansion of the housing. Whereas all other indicator types, and especially the magnetic and electric-resistance types, require water or blower cooling, it will be shown further on that with the quartz indicator it is possible by skillful design to so reduce this temperature sensitivity that no water-cooling is necessary for practical tests.

The object of calibration at high temperature is to determine changes in the original calibration curve. Unfortunately, calibration with oil pressure is not practical at high temperatures, and it is necessary to use the more dangerous compressed air, which in case of failure is apt to give unpleasantly high velocities to the projected parts. For this reason it is necessary to be very careful when making calibrations with compressed air, especially at the higher temperatures.

The temperature of the indicator on the engine is by no means a locally-constant factor; there develops in the indicator a complicated temperature field which is dependent on many variables.

Evidently it would be incorrect to heat the entire indicator to a uniform, high temperature, a condition which might possibly show the same calibration constant as the room-temperature test. On the engine the indicator, in consequence of the non-homogeneous interior temperature field, would, nevertheless, give incorrect results. Especially-steep temperature gradients are met with in water-cooled indicators. For this reason the author, in collaboration with E. Czerlinsky at the DVL, developed a calibrating apparatus which works with compressed air, with which the indicator is screwed into an electric tubular oven which withstands up to 100 atms. at 1100 deg. Fahr. Conditions on the engine are thus simulated to a large extent, and temperature measurements are preferably made close to the mounting thread. Temperatures at the outer end of the indicator are then materially lower, in conformity with conditions on the engine. For the same reasons, in the case of water-cooled indicators, the water-cooling system must be operating while the instrument is being calibrated.

The test temperature preferably should be the highest temperature which may occur in the cylinder walls of engines, and especially of air-cooled engines. According to to DVL experience, the highest possible temperatures are 535 to 555 degs. Fahr., which occur in the most unfavorable cases while the engine is knocking. S. Hesse and K. Campbell found no higher temperatures. Indicators for use on air-cooled engines therefore may be calibrated at 525 deg. Fahr. Placing the calibrating temperature higher, say at 572 deg. Fahr. (300 deg. C.) would be unjustifiably

[1] See comment at end of article.
[2] See comment at end of article.

severe, because the maximum temperatures mentioned in the foregoing are reached only in very rare instances. Even when calibrating at 525 deg. it must be expected that many indicators which give sufficient accuracy at the low temperatures of water-cooled engines, show up very poorly. A second upper limit, for liquid-cooled cylinders, is hard to set, because the temperature of the cooling medium does not permit of judging that of the indicator. As a matter of fact, owing to heat flow through bosses in the cylinder wall, there may be much higher temperatures in the indicator itself. As the temperature gradients are very steep and the heat-flow conditions are very complicated, it is impossible to even approximately evaluate the temperature difference between indicator and cooling medium, which varies from case to case. It is therefore the best plan to assume for liquid-cooled cylinders also a maximum of 525 deg. Fahr. and to make this the calibrating temperature.

As an example of a successful temperature test, in which, however, the proposed temperature limit of 525 deg. could not be maintained, there is shown in Fig. 1 the calibration curve of an uncooled DVL quartz indicator, which at substantially 390 deg. (at the mounting thread) shows practically no change from the cold calibration.

If the warm calibration shows a material deviation from the "cold" calibration curve, the cold calibration must be repeated after the indicator has cooled off, and if the new test shows permanent changes in the indicator, this, of course, further impairs the record of the indicator under test.

SHOCK SENSITIVITY, NATURAL FREQUENCY—Determination of sensitivity to shock involves a very difficult problem, because it is hard to find a generally-applicable definition for this characteristic. An approximate indication of the possible inertia error is obtained from a comparison of two diagrams made with different indicators. True, there then follows a difficult discussion of the question as to which of the harmonics of the indicator diagram are genuine and which are due to errors in the indicator. A better test would be possible if steep pressure gradients of accurately-definable form could be produced with oil or compressed air[3]. A substitute method, proposed by Beale and Stansfield, which in many cases permits of a certain dynamic indicator test, provides for the use of a very small change-over valve. But even with this, one does not get a quantitative measure of the sensitivity to shock of the instrument under test.

Neither does the use of vibrating tables accomplish the object, because their frequency seldom exceeds 30 cycles per second, and, besides, their motion involves numerous complicated harmonics. Electric excitation of the quartz system also did not give the desired result, because the exciting piezo-electric energies are too small by several orders. With other types of indicator, particularly the magnetic type, this method should give good results, however.

From diagrams taken on larger engines it is known that valve shocks, which may be very severe, can produce faulty deflections or vibrations in the pressure diagram, if the work is being done with an indicator of high shock-sensitivity. The idea therefore suggested itself that engine conditions might be simulated in the test in this respect also, by subjecting the instrument to shocks or hammer blows. With an amplifier and a recording apparatus of excellent frequency-response characteristic, the natural frequency of the instrument must be observable in the diagrams.[4] Since the present report was completed, E. Czerlinsky at the DVL has succeeded in determining the natural frequencies of all available indicators by subjecting them to blows.

DVL METHOD—When throwing balls of 10 and 13 mm. diameter on the instrument, there at first appeared peculiar bounces, which it has been impossible to fully explain thus far. Instead of the expected sharp peaks, the zero line shifted quite perceptibly (change in initial pressure). This phenomenon was most pronounced with the smaller ball. It could be prevented by changing to larger masses and smaller heights of drop. Apparently this bouncing of the zero line is related to the steepness of the pressure rise, which, naturally, increases with the height of drop.

Best results were obtained with a drop bar of round steel of 10 mm. diameter and 260 mm. length (Fig. 3), which weighs approximately 5.3 oz. For indicators having small-bore connections, one end of the rod was turned down to 3 mm. diameter. The rod has a scale engraved on it and is guided by a tube, which makes it easier to hit any desired part of the indicator. The optimum height of drop was found to be 3 cm. With a drop of only 4 cm. the bouncing of the zero line referred to in the foregoing was already plainly noticeable.

As shown by the oscillogram, Fig. 4 (owing to the high velocity of the tracer point it was necessary to go over the deviations by hand to make them fairly plain) such a blow is exceedingly hard. The deviations last only from 0.2 to 0.3 milli-seconds, the rise is completed in approximately 0.1 milli-second. The absolute amplitude varies between 100 and 400 lb. with the different indicators, the reason for the differences being that with an equal impulse the shock depends also on the mass and the elasticity of the indicator itself. There even were variations with the same indicator, which is due to the fact that the nature of contact between the colliding bodies is not always the same. An oil film, for instance, materially reduced the severity of the impact. A superficial calculation of the conditions of impact led to the following results: Final velocity of the dropping rod, 2.50 ft. per sec.; one-half the time of impact (till $v = 0$), 0.0001 sec.; acceleration (assumed to be constant), $-760\,g$; pressure (assumed to be constant), 242 lb. By assuming that the pressure and acceleration increased in proportion to time it was found that agreement with the experimental value was not so good (485 lb.)[4]. A more exact evaluation of Fig. 4 would be of no value because the frequencies found, up to 10.000 cycles per second, come close to the limit of performance of the apparatus used.

The investigations showed that the blow thus standardized was sufficiently defined and constant. If this blow was directed against the housing of the indicator,

[3] See comment at end of article.

[4] See comment at end of article.

the resulting throwout was a direct measure of the shock sensitivity of the instrument. It was found that the blow must be directed at a particular point of the housing, but why this is so has not yet been fully explained. Since in regular service the indicator is pressed against the engine with its thread, it must be stressed there also in the test. Results were quite different when the blow was directed against the lower end of the thread and against the under surface of the mounting flange, respectively. The flange surface was finally chosen as the proper place to apply the shock. In order that the different sensitivities of the indicators might stand out in the results, a second blow was imparted immediately before or after the first one, to the pressure-sensitive member of the indicator (diaphragm or piston). The ratio between throwouts with the shock directed at the housing and at the pressure-sensitive element respectively, expressed in per cent, then represents the shock sensitivity of the instrument under test in actual figures.

TEST RESULTS—Tests were made chiefly on DVL indicators; those on other indicators were made solely for purposes of comparison.

When tests were repeated on the same instruments, there were found to be remarkable differences in the results. At first these variations were ascribed to the method, but this was found to be without justification. After a sufficient number of series of tests had been run, it was found that the interior condition of the indicator often is unstable, and that this results in the variations noted. With the DVL indicator the initial pressure on the quartz crystals could be varied and its influence on the shock sensitivity demonstrated. For instance, an indicator with a 12 x 1.25 mm. thread showed about 5 per cent shock sensitivity with low initial pressure, 2 per cent with medium, and 0.9 per cent with strong pressure. The percentages found correspond to the valuations which could be applied to the different indicators on the basis of their behavior on the engine, with the difference that this method eliminates the personal equation.

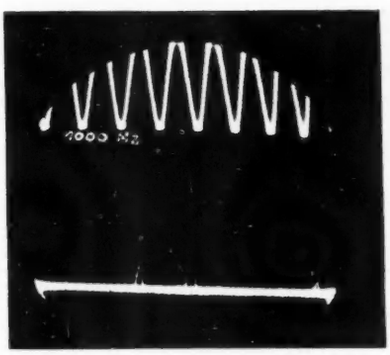


Fig. 4—Oscillogram of a shock test (impulse on diaphragm). The three throwouts or peaks correspond to repeated impulses of the drop bar.

The method described can be applied also to other than piezo-electric indicators. After the instrument has been subjected to an impact in this way, it should be recalibrated while cold, as many indicators are permanently affected by the blow.

Physically the vibro-mechanical properties of the indicator system are determined by its natural frequency and its damping coefficient. If in spite of this the shock test is preferred, the reason is that the shock test described very closely simulates the shock stresses imposed on the instrument when in service on the engine, in consequence of which other errors as well, such as those due to the cable and the cable-end closure, are included. Finally, measurement of the natural frequency is possible only with the very best amplifiers and recording apparatus, which are not always available.

SUPPLEMENTARY APPARATUS — A disadvantage of electrical indicators is their need of extensive and complicated supplementary apparatus which, if it is to be employed with success and without injury, must be turned over to an expert[5]. There is no room here for details, and only the most important questions that arise when taking engine diagrams will be taken up here. Among the general requirements are that the bulk and weight must be severely restricted and that the apparatus must be adapted for connection to common service mains. For investigations during flight—the carrying out of which generally involves difficulties—insensitivity to vibration also is one of the requirements.

OSCILLOGRAPH—The older of the two types, the coil ocsillograph, has been rather highly developed for years, and has the important advantage that up to eight variables can be recorded on the same film. Its "linearity" and its indestructability also must be acknowledged. Its disadvantage resides in the still-present dependence on frequency, which, however, has been greatly reduced in the newer coils. There are now oscillograph coils which have a natural frequency as high as 20,000 cycles per second, so that with strong damping they can record phenomena with up to 10,000 cycles per second with a fair degree of accuracy. The coils work with currents of a few tenths to a few hundredths of a milli-ampere, the resistances are of the order of 1 ohm[6].

In contrast to the above, the second type, the cathode-ray oscillograph is sensitive to voltage and presupposes only small output of the amplifier. Gas-filled electron tubes work without lag up to 10,000 cycles per second; vacuum tubes[7] even up to highest frequencies. The time required for the flow of the electrons plays a role only in so far as the record appears on the screen a trifle later than would correspond to the actual phenomenon recorded. One of the disadvantages of the cathode-ray oscillograph resides in the difficulty of recording several phenomena simultaneously. True, there are two and multi-ray tubes, and also makeshifts for this purpose, none of which, however, attains the reliability and simplicity of the coil oscillograph. In addition, with the cathode-ray oscillograph the sensitivity is dependent on the operating voltage, and with the curved screens the "linearity" of the deflection is not always sufficient. Finally, the time scale can be made only approximately linear, in contrast to the absolutely constant velocity of the paper strip in the coil oscillograph. On the other hand, the cathode-ray oscillograph offers the possibility of making the transverse motion proportional to the piston travel, so that a p-V diagram can be traced

[5] See comment at end of article.
[6] See comment at end of article.
[7] See comment at end of article.

directly. However, for correct evaluations the transmission of piston travel must then be corrected to within one degree of crank angle (which is not easy to attain), as otherwise very strong distortions result. The width of line in proportion to the screen area is substantially the same in both types of oscillograph. It is, therefore, impossible to give a general opinion regarding the relative values of the two oscillographs, and the question as to which of the two is best adapted for the purpose must be decided separately in each case. A valuation of the two types is of no great importance in the framework of this discussion, since the instruments now being furnished by industry are very much on a par with one another, and in case of failure, can be readily exchanged for another model. For investigations on engine knock, with vibrations of the order of some thousands of cycles per second, in which the absolute pressure and its relation to the crank angle are of no great importance, only the cathode-ray oscillograph deserves consideration. If, on the other hand, the diagram is to be evaluated with respect to output, the coil oscillograph is likely to be given the preference. Besides, use of a sluggish oscillograph coil hardly reduces the requirement of independence of frequency of the indicator, since the valve shocks referred to in the foregoing, with their throwouts, in diagrams from poor indicators, are shown also by coils of low natural frequency.

In the test for indicators described in the foregoing, it is advisable to use the cathode-ray tube to determine the shock sensitivity, the coil oscillograph or a precision indicating instrument for the determination of temperature influences, etc.

AMPLIFIER—With the exception of the carbon-disk indicator—and that is its chief advantage—all electrical indicators require an amplifier, because their electrical outputs are too small. The amplifiers must be specially fitted to the type of oscillograph, in that for the coil oscillograph they must furnish relatively large currents with low resistance in the output circuit, while for the cathode-ray oscillograph they must furnish relatively large voltages in an output circuit of high resistance. Under certain conditions both requirements can be met by a single apparatus with a suitable commutating switch. The alternating-voltage amplifiers commonly used in radio are not suitable for indicator purposes, because they respond only to variations in voltage and, therefore, cannot indicate zero pressure, thus making impossible a slow static calibration of the indicator with amplifier[8]. Alternating-voltage amplifiers may be inserted in the circuit in an emergency, for the enlargement of a diagram, but the absolute values of the pressures are then lost.

For indicators, and especially the piezo-electric type, direct-current amplifiers, which still transmit satisfactorily at zero frequency, are necessary[9]. For best results the input-circuit resistance must be adjusted to the resistance of the indicator. In the case of quartz indicators it must be as high as possible, of the order of 10^{12} to 10^{15} ohms, hence only electronic tubes can be used. The final criterion is not the resistance in ohms but the time constant $C \times R$ of the input circuit, which can be measured by observation of the rate of voltage drop dV/dt, by means of a stop watch. For accurate calibration this time constant must be of the order of 1000 seconds.

Aside from having a correctly proportioned input-circuit resistance, the amplifier must amplify the value to be measured linearly, that is, without change in the amplitude and frequency relations. Since all amplifying tubes have at least a slightly curved characteristic (that of the "electrometer" tube being curved particularly), a perfectly linear amplification is impossible[10]. However, an approximation to within ±2 per cent should suffice in most practical cases. Owing to the tendency of all amplifiers to change with time, whenever very accurate measurements are required, the characteristic should be verified a number of times, and it can then be used to make corrections for non-linearity.

The dependence on frequency is determined by the frequency-amplitude characteristic of the amplifier. To obviate the necessity of securing data for the entire curve every time, it is advisable to choose a particular frequency for a standard and to give the reduction in the amplification at this frequency as compared with that at zero frequency. A suitable standard frequency is 10,000 cycles per second, because this is the practical limit for both the coil oscillograph and the gas-filled cathode-ray tube. The largest permissible dependence on frequency of the oscillograph varies with the purpose for which the instrument is intended. In the case of coil oscillographs, 20 to 30 per cent damping at 10,000 cycles per second is permissible, because many coil oscillographs have a much poorer frequency-amplitude characteristic. For cathode-ray tubes, on the other hand, the frequency-amplitude characteristic cannot be good enough[11]; there are direct-current amplifiers whose damping at 10,000 cycles amounts to only a few per cent.

CABLES AND CONNECTIONS—To meet requirements of test-stand operation, the cables and connections must be robust and resistant to water and the working media. In the case of piezo-electric, and also in that of electrostatic indicators, there is the additional requirement that the capacity of the input circuit be very low[12], with the greatest possible resistance, and that no supplementary charges can be formed by shocks. Unfortunately, the latter requirement cannot be completely met with any flexible insulating material. All cables, and especially rubber conduits, give off measureable charges when bent or pressed, which in the event of shocks can produce throwouts in the diagram. However, it is not necessary to make a separate investigation of these faults, as they will be noticed during the test for shock sensitivity discussed in a preceding paragraph.

Following are the characteristics of three quartz indicators of 18, 14 and 12 mm. thread diameter developed at the DVL by the author and H. Wende:

Width of hexagon (wrench opening), 0.945 and 1.025 in. Height without electric terminal, 1.85 in.; weight, 3¼ to 4½ oz.; measuring range, 100 atmospheres;

[8] See comment at end of article.
[9] See comment at end of article.
[10] See comment at end of article.
[11] See comment at end of article.
[12] See comment at end of article.

no special cooling; maximum permissible temperature (at the thread), about 750 deg. Fahr.; these indicators ran 75 hours on a BMW engine, mostly knocking, with 87-octane fuel, varying mixture ratio, supercharge ratio up to 1.7, compression ratio, 6.5. At the end of this period there was no change in the indications. It is probable that the quartz crystals had split, but this did not affect the operation of the indicators. The "cold" calibration showed that the characteristic was linear to within ±2.5 per cent. At a temperature of 390 deg. Fahr. the characteristic also was linear to within 2.5 per cent. The sensitivity to shock, determined by the DVL method, was found to be 1 per cent, and the natural frequency of the instrument, 50,000 cycles per second.

Following are some comments on the foregoing paper by Messrs. Fried and Schrader of the RCA Manufacturing Company, Inc., to whom a copy of the translated paper was submitted for the purpose.—Editor.

[1] Electrometer tubes especially designed to have very low grid current and high grid - to - cathode resistance. We have found it possible to use standard tubes operating under reduced voltage conditions for this purpose.

[2] If properly designed, the phase shift of the amplifier may be made negligible and such as to not change with age. Or the angle marking voltage may be introduced in the amplifier near enough to its input terminals to make phase shift negligible.

[3-4] RCA has used a square wave form of pressure wave which has been found very valuable to run down vibration problems. These square waves of air pressure may be applied at a rate as high as 30 times per second and with pressure of from 0 to 500 lb. per sq. in. This rise time of pressure, even at a rate of 30 per second, is negligible. With a test of this type the rate of applying the pressure should not materially affect the test, and any resonance effect should manifest itself on the pressure curve observed as below (see sketch).

[5] We do not agree with this statement. Much more complicated electrical equipment is in everyday use. True, some education of the user is necessary, but this need not present any great difficulty.

[6] This is indeed news. If true, these oscillographs are more sensitive than our most sensitive meters which have extremely poor frequency response, give no indications on frequencies of over 2 or 3 cycles per second. I suspect that milli-amperes should be amperes. I would hesitate to say what is correct. (The German text uses the abbreviation mA, which evidently means milli-amperes.—Editor.)

[7] Gas-filled tubes in this country are no longer used, except in a very few cases. Vacuum tubes are used at frequencies up to several hundred megacycles, in radio developments. Voltage regulators make changes of supply voltage negligible. Calibration of the time scale can be readily accomplished. Furthermore, methods of indicating phase (crank position) on the screen of the oscillograph make linearity unimportant. The time scale can be made absolutely linear if desired. Curvature of the screen of the oscillograph tube is negligible in most cases.

[8] Special amplifiers have been built to overcome this difficulty, but they are not generally available.

[9] This is only necessary when it is important that zero pressure be accurately indicated on the diagram. The rest of this paragraph is true only when static calibration of the indicator is required. If dynamic calibration methods are used the time constant must be long with respect to the lowest speed of the engine with which the equipment is used.

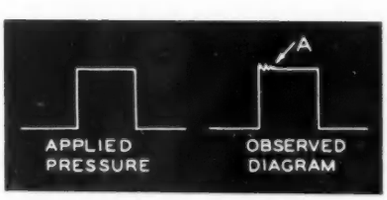
Fig. 5—Three DVL quartz indicators compared with an 18-mm. spark plug.

[10] Linear amplification *is* possible, as evidenced by amplifiers which produce less than 0.2 per cent distortion in use every day b yalmost all broadcast transmitters.

[11] I do not agree, as amplifiers have been built with negligible phase shift or frequency-amplitude characteristic to several hundred thousand cycles per second. Certainly well above any frequency possible in the combustion chambers of engines.

[12] The capacity of the input circuit affects only the sensitivity of the pressure indicator. Its only effect on the frequency-response characteristic is to improve the low-frequency response. This is even borne out by the statement (in the Section on Amplifier) that the time constant CR must be large. Thus high C and high R are both desirable. High C is much easier to attain than high R, and is also much easier to maintain over long periods of time.

Square-wave form of pressure cycle used for indicator tests by RCA.

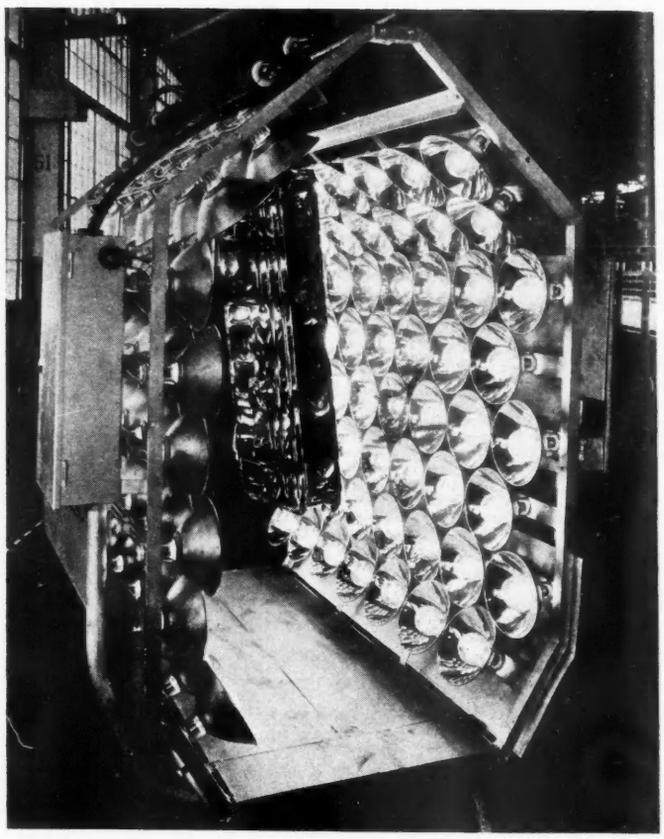


MEN and MACHINES.

INFRA-RED lamps are being used quite successfully by a number of motor vehicle manufacturers to speed up drying operations. This is a relatively new development, starting in 1933 when synthetic resin enamels were introduced, and it appears to be making substantial headway. Present automotive users of the method are Ford, Chrysler, Plymouth, Nash and Studebaker. While the latter four employ radiant heating installations only for body repair work, Ford is using more than 10,000 infra-red lamps on a variety of operations, such as the drying of priming coats of paint, first coat enamel, some finish enamel and all repair enamel. Ford also employs the infra-red lamps for drying many kinds of materials and heating aluminum pistons for reconditioned engines up to 110 deg. Fahr., causing sufficient expansion to permit piston pins to be slipped into place. A 90-ft. body tunnel in Ford's River Rouge plant at Dearborn, Mich., utilizes 4800 260-watt lamps. With the new equipment a priming coat is dried in 10 min., whereas an hour formerly was required for the same operation. It should be pointed out, however, that infra-red drying of bodies is presently only suitable for primer and first-coat enamel.

Some information on the fundamental principles of the process is found in Patent No. 1,998,615 which was issued in 1935 to F. J. Groven. The patent states, "It is not known definitely what causes the remarkable results obtained with this process, however, the following explanation may be correct and is given as a possible solution. When heat rays fall upon any substance, part is transmitted through the substance, a part absorbed and a part reflected. The reflected part is immaterial here but the parts transmitted and absorbed are believed to be important, depending upon the wave lengths of the radiation and upon the character of the substance. By transmission is meant the penetration through the substance at a particular depth and by absorption is meant the stoppage of the heat waves within the particular depth. It is believed that with the carbon filament bulb as a heating unit, wave lengths are projected, a large percentage of which penetrate almost through the layer of enamel so that surface heating is retarded while at the same time the penetration dries the enamel uniformly over its full depth."

A pioneer manufacturer of infra-red ray lamps, the North American Electric Lamp Co., St. Louis, Mo., claims four main advantages for the process of drying, baking or heating with radiant energy, as follows: Minimum of space required for drying equipment; complete elimination of oven "warming-up" time; quickest drying time; and more uniform drying.



Infra-red lamps made by the North American Electric Lamp Co. are used in this installation at the Ford River Rouge plant for drying freshly painted gasoline tanks.

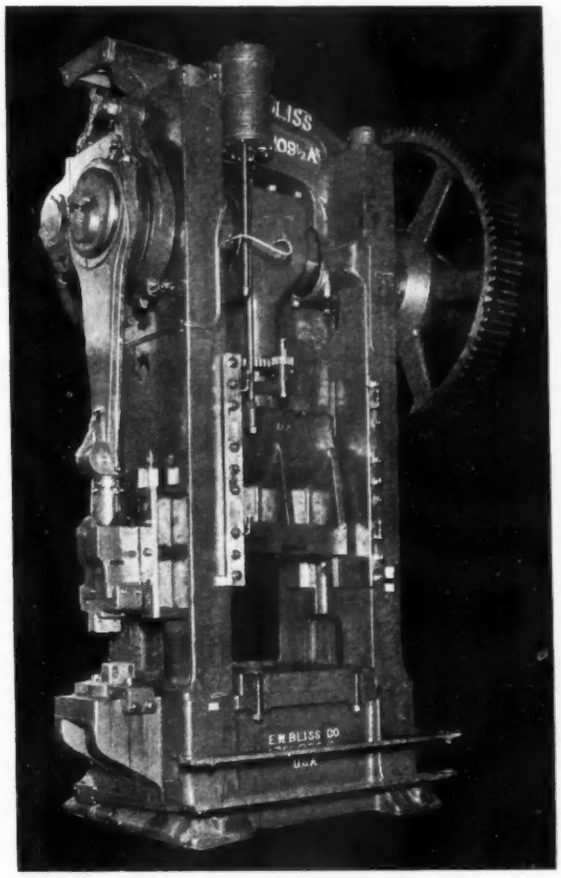
The accompanying illustration shows clearly how simply the "Dritherm" lamp units made by this company can be mounted. Any standard conduit, channel or angle iron that can be formed into a metallic frame is suitable. Inasmuch as very little weight is involved, the use of light material is possible. Simplicity of installation is emphasized further by the fact that casings or housings are not required. Any standard socket suitable for mounting on a metal frame is satisfactory.

It is pointed out by Nalco that reflectors should have highly polished surfaces, and must be highly resistive to the corrosive effect of gases as well as to the heat developed. Gold plated reflectors are said to give the most satisfactory results, although polished aluminum and processed aluminum reflectors are very satisfactory. Reflectors may be either parabolic or spherical in shape. The parabola will provide the necessary concentration when used over a conveyor carrying the product. If the products are in motion there is no

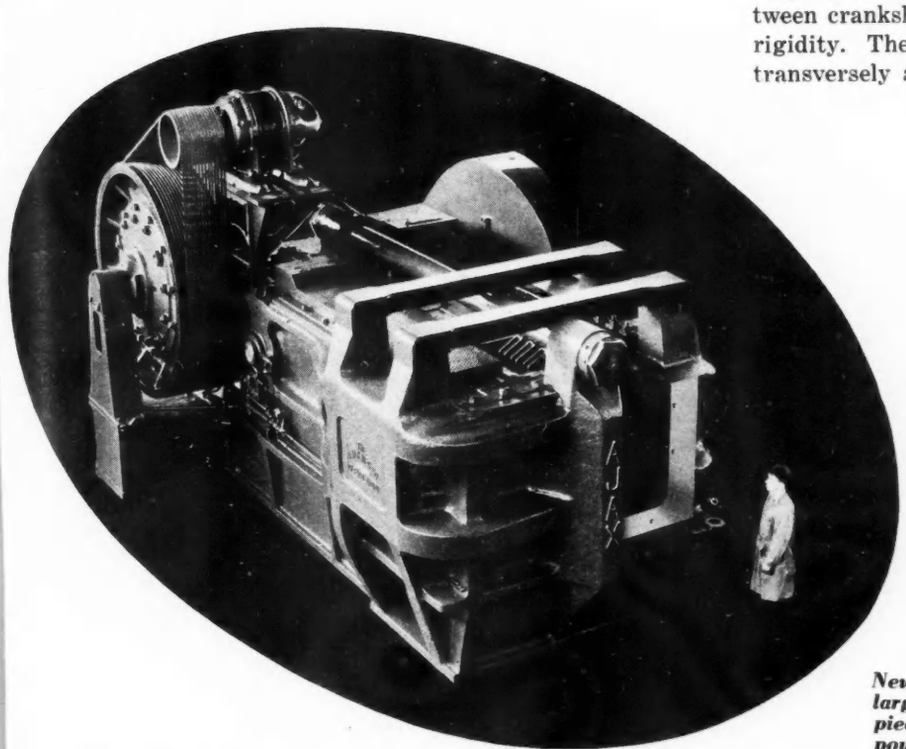
spottiness as a result of separate beams from the concentration. Spherical reflectors will re-direct a larger percentage of the radiant energy for a given diameter. Distance to place the reflectors from the work varies from 9 to 18 in., depending upon the product undergoing treatment. It is noted also that the reflectors should be placed in banks close together—rims touching.

AN 8-in upsetting forging machine weighing nearly half a million pounds and incorporating unusual construction features for a machine so tremendous in size was designed and built recently by the Ajax Mfg. Co., Cleveland. The machine is built to accommodate dies 46 in. high in order that dies with as many as four progressive operations for fabricating heavy forgings from large stock can be handled entirely within the die seat. It is driven by a 150-hp. motor through V-belt drive to a flywheel and air clutch assembly weighing approximately 35,000 lb. that is carried on anti-friction bearings.

The machine is fed from furnaces on either side by means of cranes which transport heated stock from the furnace to the throat or feed gap, support the bar in position between the dies for the operator, and return the bar to the furnace for heating for the next forging. A one-piece integral frame without joint between crankshaft and dies provides great longitudinal rigidity. The frame construction is especially rigid transversely also, due to deep "C" clamp distribution of metal beneath the throat and the two heavy transverse tie clamps above.

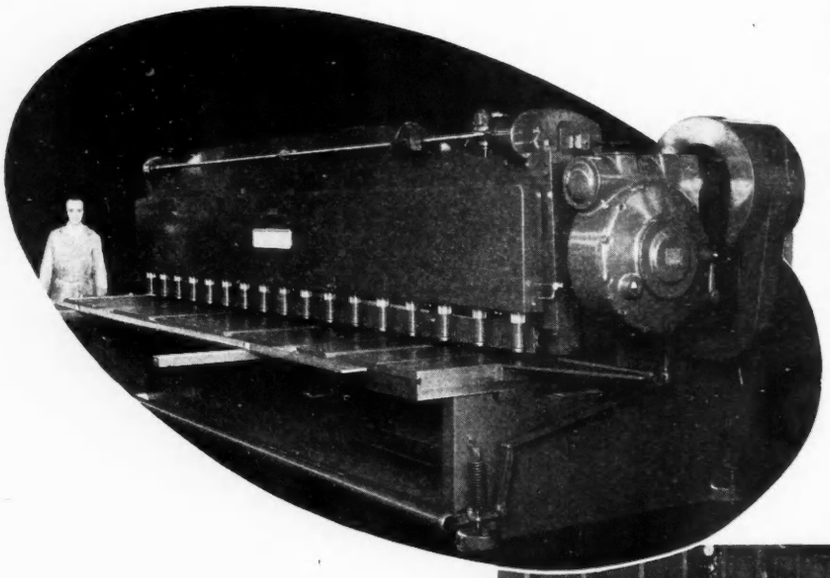


Bliss No. 209½ straight-sided single crank press. This machine is single geared and operates at 25 strokes per minute.

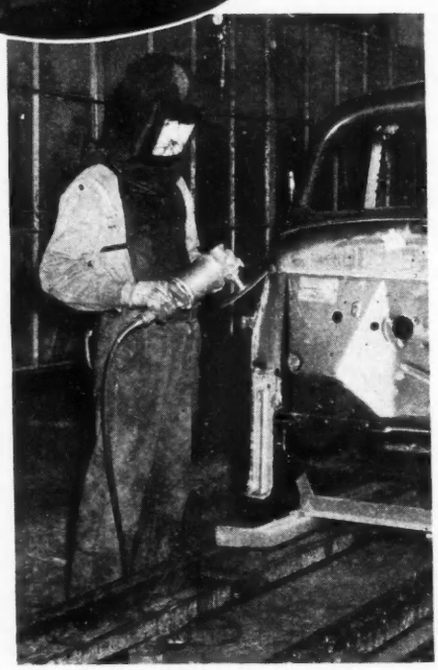


New Ajax eight-inch forging machine—the largest of its type ever to be built with a one-piece frame. It weighs nearly a half-million pounds.

A ⅜ in. by 16 ft. steel plate shear is the newest machine to come out of the Cincinnati Shaper Co.'s plant in Cincinnati. It is designated by the manufacturer as No. 4316 and its features include hydraulic hold-downs that automatically clamp any thickness of metal with the same pressure and prevent creeping of the sheet or plate; low rake of the blade that reduces the twist in narrow strips; inclined upper knife that produces a sheared edge that is square with the surface of the plate;



Left
Cincinnati 4316 series ⅜ in. by 16 ft. steel plate shear.



Below
Protection of workmen against silicosis and other occupational diseases caused by inhalation of dust or fumes is offered by this new hood introduced by Jackson Electrode Holder Co., Detroit. Light, flexible, fabric-bound hose clipped to operator's belt and equipped with quick detachable fitting can be connected with plant air line.

micrometer dial, ball-bearing back gage that is said to make gaging unusually rapid; a safety friction provided for protection against overloading; and all-steel construction.

ANNOUNCEMENT of a complete line of standard carbide cutting tools has been made by the Wesson Co., Detroit. The manufacturer emphasizes that economies made possible by the combination of large volume production and a newly developed Wesson process make possible prices which in some cases are actually lower than the price of high-speed steel tools of the same size.

At present Wesson standard cemented carbide tools include reamers, shell reamers, core drills, end mills, counterbores, and inserted blade milling cutters. They are produced by a process which has involved the development of a new treatment for shanks and bodies. An important feature is hardening at temperatures which do not injure the bond or the carbide insert.

THE E. W. Bliss Co., Brooklyn, N. Y., has developed a new line of trimming presses for use in the forge shop and other kindred industries. The No. 209½, a straight-sided single crank press illustrated herewith, is one of many presses in the new line. It is equipped with an outside slide or cut-off attachment for cutting the flash from the bars, punching holes and trimming. The press is of tie rod construction with the steel tension rods shrunk in at 100 per cent over the press rating, and with beam and compression members cast from modern irons of good tensile strength, high compression strength and hardness, and with good shock absorbing properties. The old split clamping action in the connections has been supplanted by solid straps with a cross grip action which insures positive holding with greatly increased strength.

Other important elements of the machine are the rolling key clutch which is made of hardened alloy steels, V-belt motor drive, extra wide bed and slide and air counterbalance for the slide. The press is furnished with a floor line lubrication system which reaches the main bearings and other points via pressure fittings that are within reach of the man on the floor. The machine is single geared and operates at 25 strokes per minute.

ADDITIONAL new developments in machine tools and allied products are as follows: "No-Kik" welding cable employing a unique method of neutralizing induction to eliminate cable kicking, at the same time reduce welding current losses, increase ease and speed of gun handling, and eliminate cable wear. *Progressive Welder Co., Detroit.*

Fifty-ton fully automatic hydraulic compression molding machine designed for molding thermosetting materials but adapted also to thermoplastics. Flash, semi-positive, positive, or split types of dies may be utilized; and a special feature is the arrangement for mounting of dies so that they move out of line while the molded pieces are being ejected. Steam-heated die plates are supplied as standard equipment; electrically heated plates can be furnished. *The Watson-Stillman Co., Roselle, N. J.*

Portable electric sander using standard 3 in. by 24 in. abrasive belts. Belt speed, 1350 ft. per min.; weight 15 lb. Designated as type G-3 Guild Sander. *Syracuse Guild Tool Co., Syracuse, N. Y.*

Improved files and file chains for Grob continuous motion filing machines. *Grob Brothers, Grafton, Wis.*

(*Turn to page* 400, *please*)

PRODUCTION LINES

Surface Quality

A proposed American standard of surface qualities (B 46) just issued by the American Standards Association marks the culmination of an activity which had its beginning in 1930. It was carried on as a joint project of the SAE and the ASME. It provides metal cutting industries with the first tangible starting point for the standardization and specification of surface quality. Since the effectiveness of an ASA tentative standard depends so much upon practical ideas from the field of industry, we should like to enter several suggestions based on contact with actual applications of surface quality measurement in the automotive industry. In the first place, we urge the committee to change the title of the standard (B 46) from "Surface Roughness" to "Surface Finish" or "Surface Smoothness" or "Surface Quality" or some suitable term intimating "fine" finish rather than "roughness." In recent years—particularly during the past two years—many leading establishments in the automotive industry have adopted the Profilometer as a means of measuring surface finish. Early this year Chrysler accepted the Brush surface analyzer as the standard of measurement. This instrument actually analyzes surface characteristics, giving direct readings rather than r.m.s. averaging of defects. Reference to these instruments is significant of the point that with the desire for measurements of the order of a few micro-inches, it is essential to substitute precise instrumentation in place of any generalized methods which may have been satisfactory heretofore.

Cuts Amortization

Recent visit to the Rockford machine tool plants brought to light some basic developments which merit the attention of all production executives. We refer particularly to the current status of the principle of unit type machines in which the most complex forms of drilling, tapping, and boring equipment are produced from absolutely standard and interchangeable units. Bases are standard, hydraulic drives are standard, driving and feeding heads are standard. Generally speaking, it is possible to build such complex machines with only the tool heads and work-holding fixtures special.

This means that even in the case of very expensive machines the amortization cost is extremely low since only the tools and fixtures need be completely amortized in any given model season. The heads, no matter how many there may be, are standard units which can be relocated or changed in angularity by the use of simple wedge blocks whenever product changes occur. We have discussed this principle of machine tool design for many years. But it is only now that the stage has been reached where the basic elements of every conceivable form of unit-type machine may be considered as interchangeable stock items.

Any observer of recent trends in machine tool development must be conscious of the ever increasing use of hydraulic mechanism and electrical control elements. To satisfy our own curiosity we made inquiry and found that machine tool engineering departments now have specialists who devote their time to electrical engineering or hydraulics as the case may be. As one chief engineer put it, the mechanical engineer quite naturally is inclined to find a mechanical solution for every special problem of design. It is the function of the specialist to seek the solution by hydraulics or electrical controls, then to coordinate his recommendations with that of the machine designers. Close cooperation along these lines has been responsible for the marvelous automatic machines now finding their way into the machine shops of the industry.

Although the electrical systems of modern machine tools are exceedingly complex they are designed with a view to trouble-free operation and are made readily accessible for adjustment or replacement or repair.

Finally it may be said that the full development of the principle of interchangeability of basic units results in not only better service facilities but also is an important element of lower machine tool costs.

Hole Finish

A novel type of combination tool for finishing fine bores has been developed by a well-known maker of tools. It's not quite out of the experimental stage so we can't give you the whole story at the moment. Suffice it to say that work up to date with connecting rod big ends indicate that this new method will eliminate grinding or other final finishing operations on precision rods. The tool appears to be a natural for cylinder bore finishing where it can eliminate the rough honing operation following finish boring.

Sheds Light

While visiting the Rockford machine tool industry recently we were shown a new Greenlee automatic screw machine which was being prepared for shipment to an automotive plant. One of the intriguing new features of this machine is the provision of a trouble light concealed in the shroud, so located as to provide good seeing for tool changing or repairs or tool setting. Nor is the light source merely a gesture. It's a 100-watt bulb. Here is a truly important step in the right direction.—J. G.

Fuel Injection System

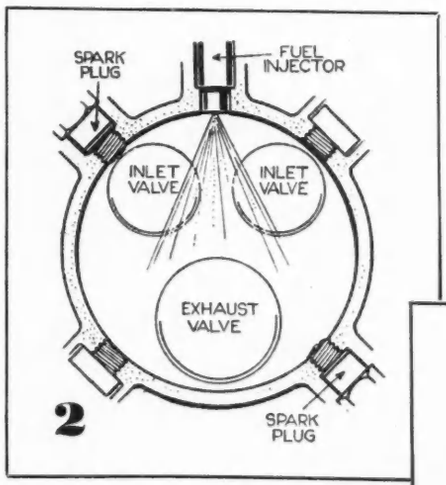
IT HAS been known for some time that the Germans use fuel injection in the latest models of their aircraft engines, which has the advantages that it makes possible a more nearly uniform distribution between the different cylinders and that it does away with the danger of carburetor icing. So far no details of the system have been published in this country, but recently the British captured a Heinkel bomber equipped with a Junkers 12-cylinder inverted V gasoline engine with fuel injection and prepared a technical description of the injection equipment. The following details and illustrations of the system are from *The Autocar*.

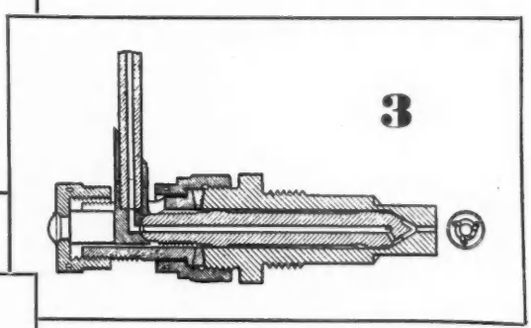
A battery of 12 fuel pumps is arranged like a V engine, so that a single central camshaft can operate all of the plungers. One of the pump units is shown in section in one of the drawings. The central plunger is operated by a cam which gives a violent outward movement but allows a comparatively slow return under the influence of a coil spring.

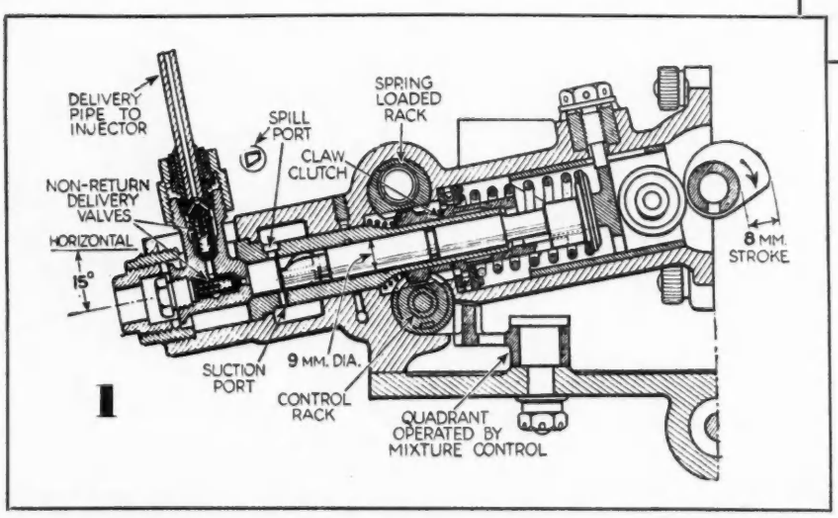
When the cam is moved inward by the spring, fuel is drawn through the suction port into the cylinder. On the outward stroke the fuel is forced through a valve into the pipe leading to the injector and so to the cylinder. A slot in the side of the plunger is adapted to register with a spill port, which latter allows the fuel to return to the suction side of the pump. Only when the plunger moves forward sufficiently for the groove to cease to register with the spill port is fuel pumped to the injector. The plunger can be rotated by means of a gear meshing with a rack. Rotation causes the groove to vary the amount of fuel which can escape through the spill port as the plunger moves, and so governs the quantity sent to the injector. In order to prevent play between gear and rack, another, single-loaded rack engages with the same gear, giving it always a definite load.

The injector is screwed into the cylinder head like a spark plug. It consists of an inner tube drilled to pass the fuel, ending in a nozzle with three holes communicating with the spray orifice. The design is such that the fuel is sprayed in the form of a cone. The fuel pipe is held to the rounded end of the injector by a union and a large nut.

The spray of fuel is shot across the combustion space between the two inlet valves toward the single exhaust valve. There are two spark plugs in each cylinder, one directly behind one of the inlet valves and





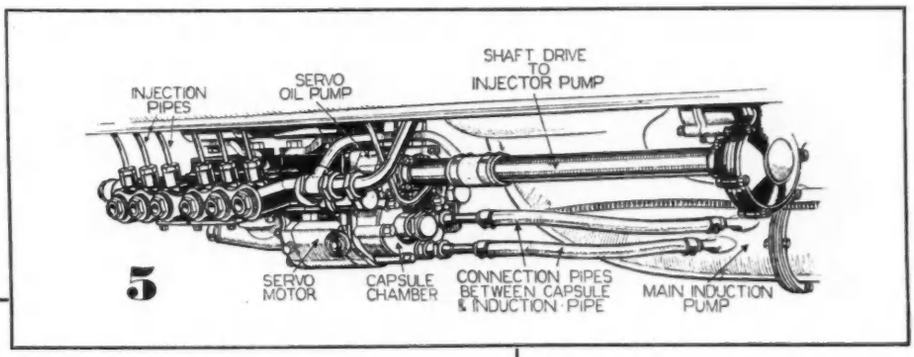


1. Cam operation is employed for the injector pumps, which have a bore of 9 mm. and a stroke of 8 mm.

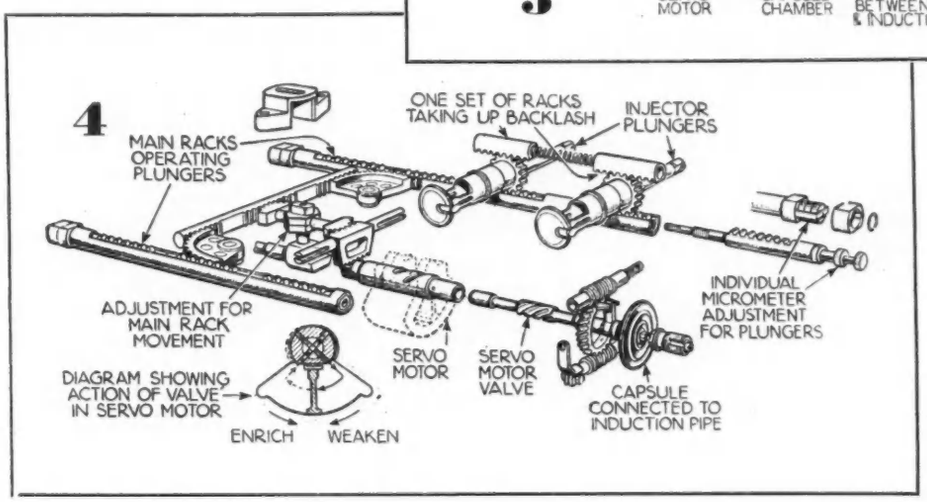
2. Diagrammatic view of the cylinder head, showing the locations of the injector and the spark plugs relative to inlet valves.

3. Injector with supply pipe. Fuel is led to three ports and thence by three spiral passages to the nozzle orifice.

Used on German Planes



4. Rack mechanism for controlling the twelve pumps.



5. The injector pumps, arranged in the form of a wide-angled V, are driven through a shaft from the rear of the engine.

the other diametrically opposite; and there are openings for two more plugs. The racks which rotate the plungers and so govern the amount of fuel supplied, are themselves operated by a series of racks and pinions from a hydraulic relay operated by the engine. This relay is supplied with oil under pressure by an engine pump, and it varies the plunger position with the air pressure in the inlet pipe. Air from this pipe is taken to a flexible chamber, sometimes called a capsicle, which expands as the pressure increases and contracts as it falls. In so doing it operates a rod carrying the valve of the relay, thus controlling the relay and through it the amount of fuel the plunger pumps supply. Manual control also is provided, and each plunger rack has an individual adjustment for the amount of fuel delivered to its cylinder.

The Junkers engine to which this injection equipment was fitted has a displacement of 2135 cu. in. and develops 1050 hp. at 2300 r.p.m. at 14,000 ft. altitude. Injection is effected under a pressure of 73 lb. per sq. in., and the fuel was found to be of quite high octane number.

The blower has two speeds and its rotor is of the enclosed type, looking like the hub and spokes of a steel wheel, with the air passing outward through the hollow spokes.

British Car Registrations in War Time

In November last, 10,070 motor vehicles were registered for the first time in Great Britain, as compared with 33,833 during the same month the previous year. The number of private cars registered (cars taxed on a horsepower basis) decreased from 23,588 to the low figure of 3549. Although the proportional decrease was largest in the highest-powered groups, it was quite large also for low-powered cars, registrations of cars of 10 hp. and under rating having decreased from 14,560 to 2477. Registrations of tractors increased from 23 to 43, and those of agricultural engines (farm tractors) from 367 to 1195, whereas registrations of motor trucks decreased from 5030 to 3334.

Fillets for Piston-Ring Grooves

IN HIGH-SPEED engines for aircraft, racing automobiles, etc., it is necessary to keep down the weight of the reciprocating parts to a minimum. Lands between piston-ring grooves therefore are sometimes made very narrow, and this may lead to fatigue failure. The resistance to fatigue failure of the land depends upon the junction between the sides and the bottom of the ring groove, or, in other words, on the radius of the fillet at the bottom of the groove. An investigation regarding the merits of different designs of ring groove from the standpoint of resistance to fatigue failure of the lands was made by Mahle Kommandit-Gesellschaft of Bad Cannstatt-Stuttgart, Germany, and reported in *Luftwissen.* The various forms of ring groove for which strength tests of lands were made are shown in Fig. 1. Width and depth of the lands are the same in all cases, and there are differences only with respect to the form of the groove bottom and the junction between bottom and sides. Both static and dynamic tests were made. The results of the static tests on the seven different land forms (in two different materials) are shown in Fig. 2. It will be seen that the two best designs are those with the largest fillet radii, the one having a fillet radius of 0.040 in. and the other a variable fillet radius decreasing from 0.060 in. at the side of the groove to 0.016 in. at the bottom. Endurance-test results on the three forms which had shown up best in the static tests are given in Fig. 3. The fillet of variable radius is referred to as a relief fillet. Polar diagrams of stress distribution with these two designs (evidently based on photo-elastic tests) show that the maximum stress is about the same for both.

In practice, instead of making the fillet radius uniformly variable, it is made to consist of two or three circular arcs, and the production of the tool for turning the fillet is specially facilitated by making the fillet in the form of two circular arcs. Fig. 4 shows the development of such a tool for a ring groove of 0.120 in. width (design g). The cutter is first ground to a semi-circular arc of 0.060 in. radius. The top portion of the half circle is then removed by grinding to a depth of 0.028 in. and the corners thus produced are rounded to a radius of 0.016 in.

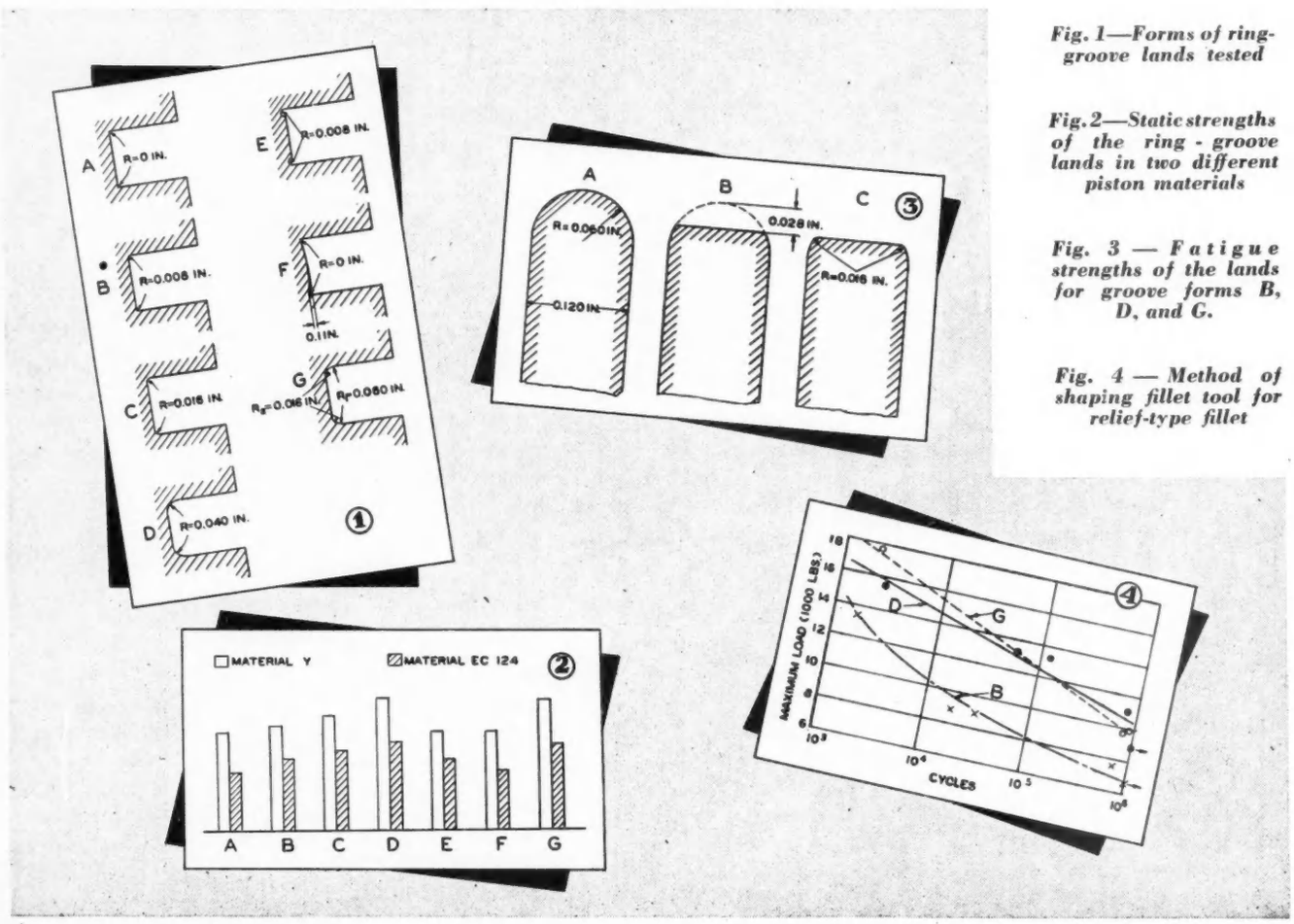


Fig. 1—Forms of ring-groove lands tested

Fig. 2—Static strengths of the ring - groove lands in two different piston materials

Fig. 3 — Fatigue strengths of the lands for groove forms B, D, and G.

Fig. 4 — Method of shaping fillet tool for relief-type fillet

New Developments in

Automotive Materials

(*Continued from page* 366)

ring sticking. These studies also brought out the observation that the only reliable criterion of the performance of a lubricant is its behavior in the engine.

Volatile Liquid Fuels

A presentation of historical data on the properties of gasoline and Diesel fuel, aiming toward a better appreciation of the trends in the properties of these materials—past and future—was made by D. P. Barnard and A. H. Fox of the research laboratories, Standard Oil Co. of Indiana. Some conclusions were drawn in this paper as to the special properties which suffice to specify the best material for any given set of operating conditions, posing the corollary that certain other tests and specifications might best be omitted in the interests of everyone concerned.

Papers on the latest developments in concrete and asphaltic materials for highway and airport surfacing mentioned new techniques which reduce substantially the cost of construction.

A Problem Solved Economically By Using Silver Brazing Alloy

Recently in a mid-west plant a need arose for larger shanks, ½ in. to ⅝ in., on some 3/16 in. and 5/16 in. straight shank drills. The expense involved in making up special drills caused this company to look for an inexpensive way of building up the shanks. After considerable experimenting, a method of brazing with a low temperature silver alloy was tried and proved successful.

New cold rolled steel shanks of the desired outside diameter were turned and drilled to give 0.002 in. to 0.003 in. clearance when the drills were inserted. Drill shanks and holes in the new shanks were cleaned and fluxed and the drill inserted in the hole. A ring of "Easy-Flo" silver brazing alloy, product of Handy & Harman, New York, was then placed around the drill. The shank was heated with a torch and when a dull cherry red color was reached the silver alloy, which flows freely at 1175 deg. Fahr., flowed and penetrated between the drill and the new shank.

Several joints were then cut apart and all showed that the brazing alloy had penetrated throughout the joint to the bottom of the hole in which the drill had been inserted. The two parts were bonded firmly together. Further tests under severe conditions resulted in broken drills repeatedly without disturbing the brazed joints. The heat required to do this job reached a dull cherry red, yet by confining it to the shanks and cooling the joint immediately after bracing, the hardness of the cutting end of the drill was not changed.

Pellets Are Basis of A New Temperature Control Technique

Tempil Corp., New York, has developed a method for indicating temperatures which simply involves the use of pellets, known as Tempils, that liquify sharply at predetermined temperatures. Each pellet is marked with a number to indicate its melting temperature. Thus, Tempil 200 melts at 200 deg. Fahr.; Tempil 300 at 300 deg. Fahr. Definite ranges are designated by distinguishing colors. It is claimed that the Tempil pellets are accurate within three per cent of the temperature which they are intended to indicate. The manufacturer emphasizes that Tempils are not corrosive to metals and will not pit or leave objectionable stains which cannot be removed.

This method has been employed for controlling preheating temperatures in welding operations; for indicating temperatures in hot operations; and, for checking thermocouples. It is pointed out that Tempils are especially valuable in determining temperatures in the black heat range.

New Automotive Brake Lining Material Developed in Germany

A new type of automotive brake lining, substituting asbestos with a lining of aluminum metal wool, has been developed in Germany, according to the Department of Commerce. The metal-fiber lining, which employs synthetic "Buna" rubber as a binding material, is described as not reacting injuriously on metal surfaces to which it is applied.

German claims are that the new product is equal to asbestos, rubber and other types of linings, and for some purposes is superior. Germany is now in a position to manufacture brake linings on a strictly domestic raw material basis as a result of the development, the report claimed.

New Temperature-Resistant Alloy Developed by Westinghouse Research

Claims advanced for a new alloy developed by P. H. Brace in the Westinghouse research laboratories state that it is stronger than any known steel, contains only seven per cent iron—yet retains its strength at temperatures higher than 2000 deg. Fahr. The new alloy, known as K-42-B, is said to be stronger at 1100 deg. Fahr. than ordinary low carbon steel at room temperature. Further, it has a low damping coefficient, in other words retains its elasticity, at such elevated temperatures. Almost half of K-42-B is nickel; about a quarter is cobalt. Other components include chromium, titanium and iron. Production of the metal on a commercial scale is known to be practical, but its first cost will be high, and its immediate uses are ex-

pected to be those of a special-purpose alloy for dies, valves, steam fittings, possibly turbine blades, or other applications requiring temperature-resistant metals.

The new alloy "creeps" a great deal less than other metals in its class. Sample rods of the metal were loaded in tension to produce a stress of 20,000 lb. per sq. in. and heated in an electric creep-testing furnace for 6000 hr. at a constant temperature of 1000 deg. Fahr. At the end of the test, K-42-B showed a yield of only one ten-thousandth of an inch for each inch of its length, and most of this had taken place during the first few hours. Westinghouse points out that, under the same conditions, a sample of high-strength nickel-chromium steel yielded 100 times as much.

A Mathematical Consideration of

The Fluid Coupling

(*Continued from page* 362)

at 3500 r.p.m. Then the amount of fluid which must enter the runner per second is

$$W = \frac{465{,}000{,}000 \times 125}{3500 \times 3500\,(6.23^2 - 4.30^2)} = 233 \text{ lb.},$$

and since there are 10 lb. of active fluid in the coupling, all of it must make 23.3 circuits per second. The longest path of the fluid is centrally along the wall of the cell and is

$$\frac{4 \times 3.1416}{12} = 1.047 \text{ ft. long},$$

and the average length is one-half of this. Hence the mean velocity of the fluid in planes through the axis of the coupling is

$$\frac{23.3 \times 1.047}{2} \times 60 = 730 \text{ ft. per min.}$$

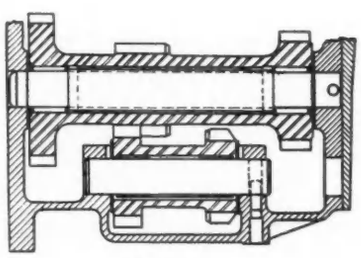
Under steady operating conditions, when the slip in the coupling amounts to only a few per cent, the flow in it is substantially of streamline character. The flow from the impeller cells into the runner cells is constant, and as the runner turns only slightly slower than the impeller, the nature of the flow is not perceptibly perturbed by the cross-over from the faster impeller to the slower runner, and vice versa. Streamline flow naturally is accompanied by only slight losses. On the other hand if, during a period of acceleration, the runner turns at only one-half the speed of the impeller, then the fluid is dashed against the impeller vanes with great force; the stream is reflected by these vanes, and if there were only a single vane, then the fluid after reflection would have zero circumferential velocity. But since the fluid is imprisoned in the cells, which turn at one-half the speed of the impeller, its velocity in space around the coupling axis cannot be reduced to zero. The result is that eddies or vortices are set up in the cells which absorb the kinetic energy and turn it into heat. There naturally is considerable eddying also in the space between the impeller and the runner whenever their speeds are materially different.

Foreign Trade in Motorcycles

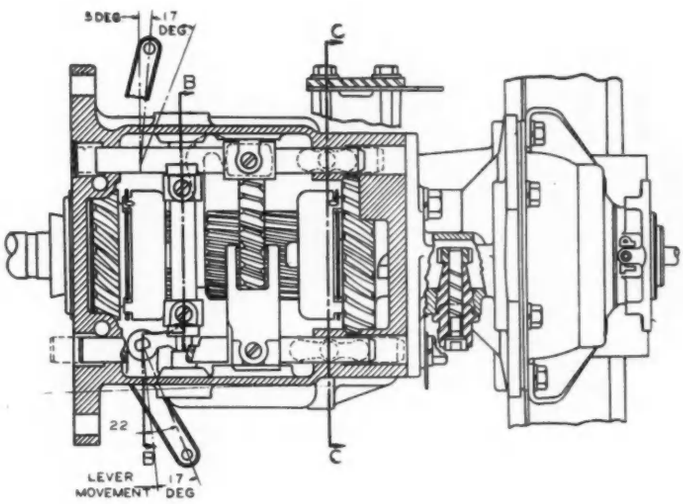
There has been a rapid change in the distribution of motorcycle exports between the several leading producing countries in recent years. Almost from the beginning of the industry Great Britain held pride of place in the world's markets, and in 1933 British exports constituted 75.2 per cent of the aggregate exports of the five leading nations (on a numerical basis), the United States following with 7.9 per cent, France with 6.9, Germany with 5.4, and Belgium with 4.6. The distribution was not so very much different on the value basis, although on that basis the United States, which exported mainly large powerful machines, had a share of 12.8 per cent of the total, while the British share was 70 per cent. Since then the British share has been decreasing continually, while that of Germany has been increasing, and in 1938 the distribution on the numerical basis was as follows: Germany, 60.6 per cent; Great Britain, 28.8 per cent; U. S., 4.9 per cent, France, 3.8 per cent, Belgium 1.9 per cent. The respective figures were very nearly the same for the first eight months of 1939, the latest available. The success of Germany in the world's motorcycle markets is said to be due largely to the fact that she produces predominantly small machines which are little more than motorized pedal cycles. This is reflected by the distribution of exports markets on the value basis, which during the first eight months of 1939 was 53.4 per cent for Germany and 36.2 per cent for Great Britain, indicating that the average value of the British machines exported was about 40 per cent greater than the average of the German machines.

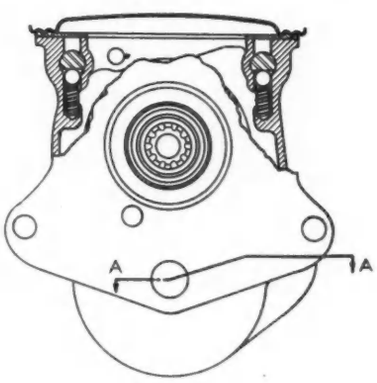
TRANSMISSION DETAILS OF THE 1940 BUICK

Rear Axle Details on the Next Page

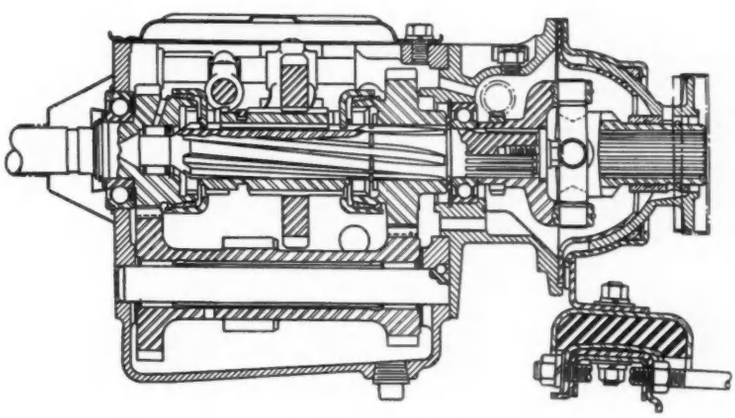


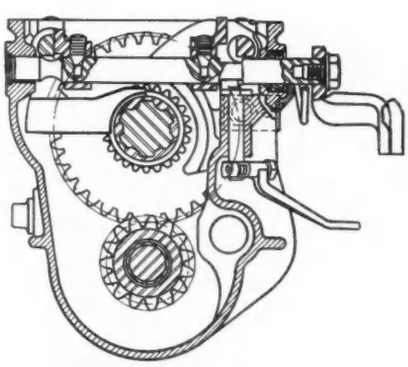
SECTION A-A





SECTION C-C





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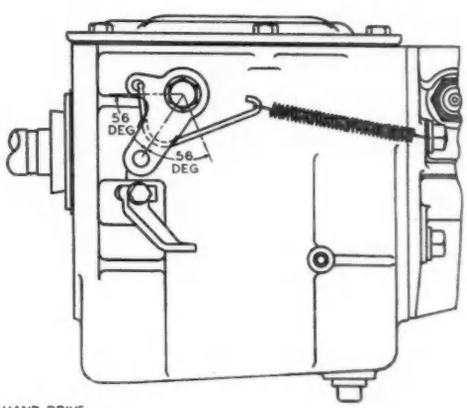
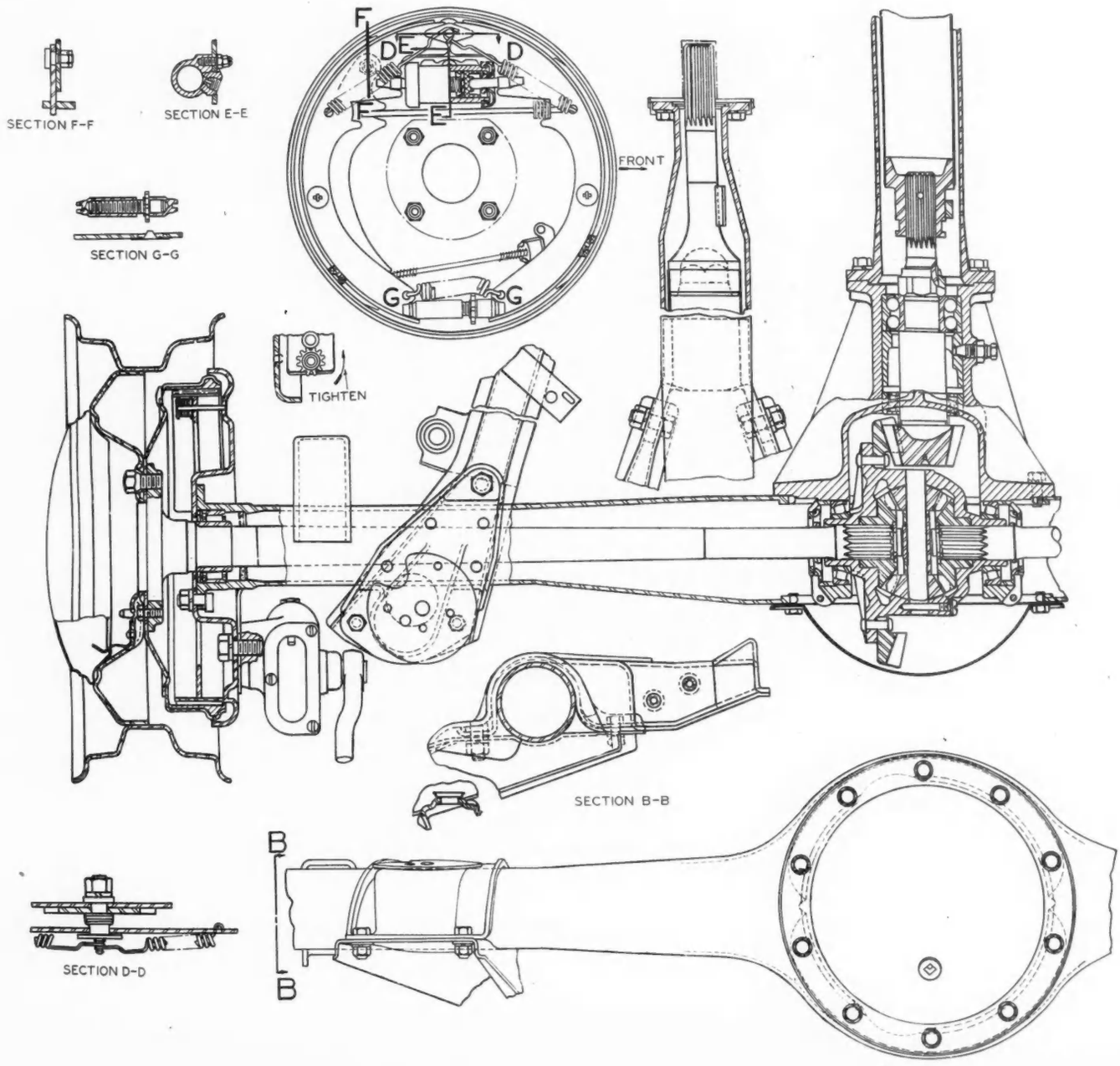


LEFT HAND DRIVE

ENGINEERING

REAR AXLE DETAILS THE 1940 BUICK

Transmission Details on the Preceding Page



NEWS OF THE INDUSTRY

Russia's KIM Well Under Way (See page 391)

February Tire Shipments Reveal Upward Movement

Shipments of automotive casings during February, 1940, are estimated to have been 4,118,030 units, according to the Rubber Manufacturers Association. This is 3.7 per cent lower than January, but is 13.1 per cent above shipments for February, 1939. Replacement shipments totaled 2,057,092 units in February. This is 13.7 per cent under January and is less than one per cent under replacement shipments for February, 1939.

Shipments of casings for original equipment purposes are estimated to have been 1,974,273 units, an increase of 9.4 per cent over the January figure and 34 per cent over February, 1939, when original equipment shipments were 1,473,664 units.

Export shipments are estimated to have been 86,665 units for February which compares with 90,409 units during February, 1939.

February production, estimated at 4,910,754 units, was 1.3 per cent under January but was 16 per cent above February, 1939.

Automotive casings in the hands of manufacturers, Feb. 29, are estimated to have been 10,156,918 units. This represents an increase of 6.1 per cent over the Feb. 28, 1939, inventory.

Stewart Begins Truck Output

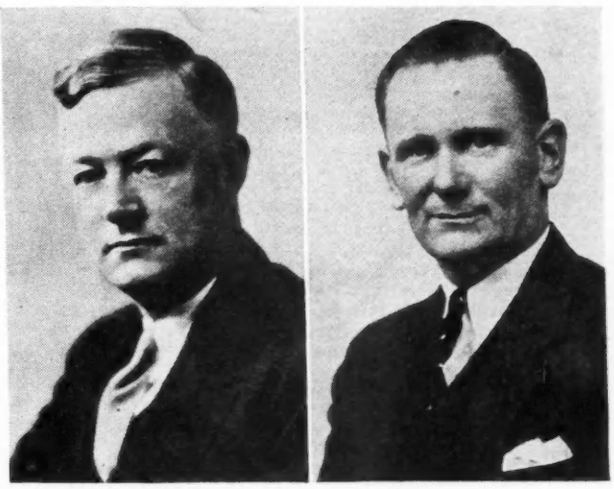
Taking the name of the former Buffalo company now in liquidation, the Stewart Motor Corp., backed by some Indianapolis capital, has started manufacture of motor trucks under the Stewart name in a plant at 201 Urban Street, Buffalo. The first truck has already been completed.

The company's personnel, according to John A. Lux, general manager, is made up of former Stewart employes. The new company will concentrate principally on the manufacture of three large models similar to the larger units formerly produced at the old plant in Buffalo.

Production of trucks will be on a small scale at first, Mr. Lux said. Some of the equipment being used in producing trucks was acquired from the old Stewart Motor plant. A large part of the former manufacturing equipment has been sold to China. President of the new Stewart company is E. E. Letzter of the Indianapolis Machinery Supply Co.

Appointed

J. D. Fletcher (left), export sales manager, and T. R. Farley, assistant to the president, have been elected vice-presidents of Caterpillar Tractor Co. Mr. Fletcher has been with Caterpillar more than 10 years. Mr. Farley for more than 20.



NADA Planning Broad Program Following Negative Referendum

Patman Is Irked at Ballot Phrasing, Will Not Introduce Bill in Congress

With the automobile dealers of the country rejecting the proposed Federal legislation of the industry by better than eight to one, the newly formed Policy and Program Committee of the National Automobile Dealers Association is now busy mapping a broad program of future relations between the dealers and the manufacturers without benefit of government regulation. Final results of the N.A.D.A. referendum on the proposed Patman-Horner regulatory bill as announced April 1 by Walter E. Blanchard, manager of the N. A. D. A., gave 975 votes for the bill and 8125 votes against it.

The other question on the ballot, asking those who opposed the Patman-Horner Bill if they approved any other type of Federal legislation for the industry, resulted in 792 affirmative ballots and 6996 votes against. A total of 628 dealers voted "no" on the first proposal and "yes" on the second one.

The tabulation revealed that 1603, or slightly more than 23 per cent, of the 9534 dealers participating in the poll favored some kind of Federal legislation. The N.A.D.A. mailed out 40,729 ballots and received a reply from 23 per cent.

Following the announcement of the vote, Stanley H. Horner, N.A.D.A. president and co-author with Representative Wright Patman of Texas of the proposed Motor Vehicles Industry Act of 1940, said, "The dealers of the country having spoken, the association will endeavor to achieve the objectives of its members through other channels in the way that appears best."

The Policy and Program committee of nine members, which had been authorized by the N.A.D.A. convention, was formed to draft a long range program. Its chairman is Herman Goodin. The other members are T. B. Attmore, L. Clare Cargile, Lynn S. Snow—all regional vice presidents—Lynn B. Timmerman, W. L. Mallon, Harry Sommers, A. H. Jones and President Horner, who is an ex-officio member. Their program of action will be submitted to members and directors for approval.

The committee met at Detroit, March 31, and a subcommittee of three was appointed by President Horner to confer with Donald R. Richberg, who has been representing the N.A.D.A. as special counsel in the hearings before the Federal Trade Commission. Under discussion was the scope of future activities on the proposed Trade Practice Rules and the possibility of initiating negotiations looking toward voluntary correction of trade practices or abuses detrimental to the industry or the public.

Congressman Patman has expressed his decision not to introduce his Bill in

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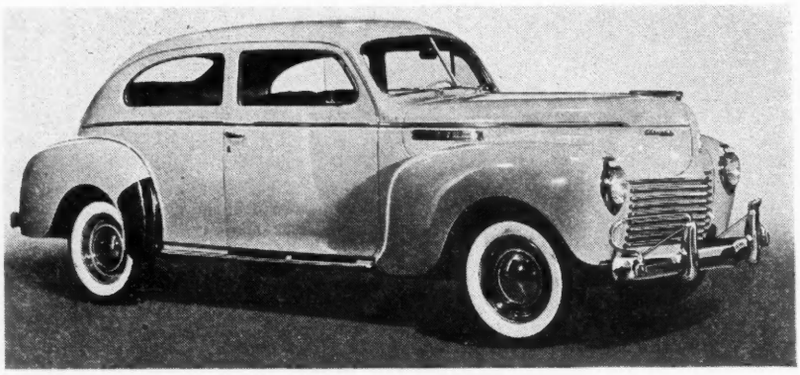

Spring Special

As part of its anniversary month program Chrysler offers this "April Special" in the form of a new brougham offered this month only at $1,045. A limited number of these cars were built, the company says, and to secure the same features in a Chrysler after April will cost considerably more. The brougham is built on the Windsor chassis of 122½-in. wheelbase with a 108-hp. engine. Standard equipment includes a radio, heater and defroster, white sidewall tires, fender guards, two-tone trim and a folding arm in the rear seat—all features generally found on higher priced Chryslers.

Should Reserve Funds for Depression, Not for Strikes

—So Chrysler Counsel Tells Commission in April 1 Hearing

Allowance of 10 days to file additional briefs and to study the 2000-page record of proof was granted counsel for the Chrysler Corp., UAW-CIO and UAW-AFL by the Appeal Board of the Michigan Unemployment Compensation April 1 in the hearing involving jobless benefits for 22,000 Chrysler workers in last fall's 54-day strike. At the hearing, Harry C. Bulkley, counsel for Chrysler, argued that Commission funds should be reserved for periods of depression and not be expended for "strike funds," as he opposed the ruling of Referee Charles Rubinoff, who had allowed $3,000,000 in benefits to 22,000 of the 41,000 workers involved.

William F. Dorn, appearing as special counsel for the Commission's original finding that no benefits were due, likewise opposed Rubinoff's ruling. He contended that the Corporation should be considered as a single enterprise due to the functional integration and physical proximity of the nine plants rather than as nine separate units. Rubinoff had taken the latter view in awarding benefits. Attorneys for the UAW-CIO and UAW-AFL supported Rubinoff's findings.

Should benefits be awarded by the Appeal Board, they would be paid immediately under the provisions of the Michigan Unemployment Compensation Act unless opposing counsel was able to enjoin the state from payment. If an injunction could be obtained, the legality of the Appeal Board's ruling might be carried to the Michigan Supreme Court for decision.

The Michigan Supreme Court recently denied the right of the Michigan Manufacturers Association to intervene in the case, upholding the Appeal Board in denying a writ of mandamus.

In its intensive campaign designed to gain a majority in the National Labor Relations Board poll to be held April 17 in 59 General Motors plants, the UAW-CIO brought John L. Lewis, president of the CIO, to Michigan to address several rallies of GM workers. Lewis, along with two of his lieutenants, Philip Murray and Sidney Hillman, spoke before 10,000 persons April 6 at Detroit and a like audience April 7 at Flint. After predicting victory for the UAW-CIO in the election, Lewis said the next task would be the organization of the Ford Motor Co. and he praised Ford Local No. 600 for its "fortitude in the face of coercion and discouragement."

William Green, president of the AFL, was scheduled to speak at Anderson, Ind., April 13 and at Flint April 14. Meanwhile, Graham Paige Local 142, last UAW-AFL local holding bargaining rights in a major Detroit automotive plant, voted to reaffiliate with the UAW-CIO. The local won bargaining rights at a labor board election June 9, 1939.

The General Motors election will be the largest in NLRB history, involving 136,064 workers at 59 plants in 11 states. Of this total 91,692 are employed

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CENSORED

An exclusive feature prepared by the London correspondent of* AUTOMOTIVE INDUSTRIES, *M. W. Bourdon.

New car sales in England are increasing each month. The latest returns of new registrations, covering January, show the highest total since September.

During the first few days of September many deliveries of cars ordered in August prevented registrations for the month from dropping below 49 per cent of the total of September, 1938. But in October they fell to only 11 per cent of the total for the same month a year earlier. November and December figures were better at 15 and 17.5 per cent, respectively. January showed a further improvement with approximately 21 per cent.

* * *

As a result of the success of the Rochdale (Yorkshire) Corp. transport department in using a mixture of 20 per cent creosote and 80 per cent fuel oil in the Diesel engines of its buses, several other municipal bus undertakings are arranging to follow suit, in order to reduce the cuts in their services enforced by the rationing of fuel oil.

In Rochdale fuel rationing compelled the bus services to be cut to 77 per cent of the pre-war standard; the use of creosote has enabled them to be put up to 94 per cent. Supplies are obtained from the corporation's coal gas production plant and the low cost (7d. per gal.) has resulted in operating economy compared with the use of Diesel oil alone—for the latter is subject to a customs duty of 9d. per gal.

* * *

A special committee of the Society of Motor Manufacturers has commenced already to consider ways and means of avoiding the dislocation of the truck manufacturing branch of the industry that followed the war of 1914-18, owing to the dumping on the market of many thousands of war service vehicles surplus to the peace-time requirements of the Army and Air Force. The dislocation continued for two or three years, and it is feared that unless preventive measures are conceived and organized in advance it will be even more serious after the end of the present war, owing to the greatly increased mechanization.

One of the remedies tried in 1919 was the repurchase from the government of the trucks of their own make by individual firms, who reconditioned and then resold them for civilian services; but in most cases this resulted in heavy loss.

February Output Up 30 P.C. in Canada

Canadian automobile production increased slightly in February when 18,193 units were manufactured compared with 17,213 units in the previous month.

Production included 12,779 passenger cars and 5,414 commercial vehicles of which 10,253 passenger vehicles and 2,955 trucks were made for sale in Canada and the remainder for export. There were 14,300 units produced in February, 1939.

Australian Manufacture Awaits Government O.K.

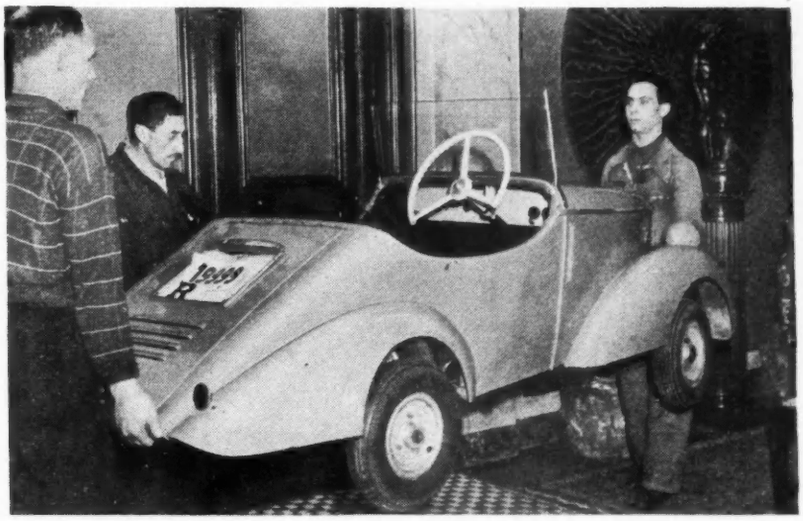
The agreement between the Australian Commonwealth Government and Australian Consolidated Industries, Ltd., for the manufacture of automobiles has been suspended pending its submission to the Federal Parliament which reassembles this month. Although a majority of the members of the parliament have been reported to favor the agreement, much criticism has been received due to the fact that the bounty contract virtually means the granting to A.C.I. of a monopoly to manufacture cars in Australia for a period of five years.

Further criticism has come from England. In the opinion of British manufacturers, it is inopportune for Australia to commence manufacturing cars particularly as the British manufacturers can supply the demand, while Australia needs all available skilled men for armament manufacture. However, some Australians view the establishment of the automobile industry as somewhat of a safeguard for the depression years which will follow the war, as it will take care of a part of the unemployment problem.

NSPA Index Shows Continued Advance

The National Standard Parts Association automotive sales index for February, 1940, was placed at 161; this was 30 points above the same month last year. The index is based on average 1934 monthly sales taken as being 100. Index of original equipment shipped to vehicle manufacturers stood at 189 for February, as against 184 last year. Export shipments advanced two per cent above January, making them 12 per cent ahead of February, 1939.

The grand index of the Motor and Equipment Manufacturers Association for February (with January, 1925, taken to equal 100), was set at 156—17 points above February 1939. The index of original equipment shipments to vehicle manufacturers was 27 points above the February 1939 mark.



Acme

. . . Then You Can Coast Down Hill

Marcello Creti, an inventive youth in Rome, Italy, has produced this one-cylinder-engined car which he says will travel 50 m.p.h. It will go, he says, 165 miles on a gallon of gasoline, carries a battery that will run it seven hours when the gas is exhausted, and is equipped with pedals that will drive it until the driver is exhausted. To garage it, pick it up and carry it into the house.

Norton Bill Heightens Wagner Act Controversy

Act Approved by AFL, Vigorously Opposed by Both CIO and Industry

Controversy over revision of the Wagner labor act at the present session has been heightened by action of the House Labor Committee in reporting out a bill and its attempt to enforce its passage through parliamentary tactics. Strongly approved by the American Federation of Labor, it is as vigorously opposed by the Congress of Industrial Organizations and Labor's non-Partisan League and industry generally. While John L. Lewis' CIO and non-Partisan League share opposition with industry to the bill, their reasons for doing so obviously are divergent. Mr. Lewis wants no change in the law at all. Industry thinks the bill is too mild, that it hardly affects the fundamental objections to the act. It favors the more sweeping amendments proposed by majority members of the Smith Special House Committee which is investigating the National Labor Board. AFL President William Green has indorsed the Labor Committee bill because it proposes amendments for which his organization long has contended.

Known as the Norton bill because the Labor Committee is headed by Mrs. Mary T. Norton, it would:

Add two members to the three-man Labor Board.

Require board recognition of craft unions for purposes of collective bargaining when a majority of a workers' unit decides it wants such representation. The Federation especially favors this amendment while CIO is bitterly opposed to it.

Permit employers to petition the board for an election when rival unions are engaged in a dispute over representation.

Require that collective bargaining contracts shall continue in force for at least a year.

The Labor Committee announced it would ask suspension of rules some time before April 15 in order to put through its amendments. Such a rule would circumvent the Rules Committee and bar consideration of the Smith amendments. There does not appear to be any chance of the House voting for suspension of the rules. To do so would require a two-thirds majority, a vote that appears improbable since there is a strong House sentiment for the Smith amendments. Hence, there is an expectation that the House, rather than passing the Norton bill, might pass the Smith bill, possibly after some modifications. However, this step toward enactment of the Smith amendments no doubt would be stopped in its tracks by the Senate Labor Committee, which is dominated even more than the House Committee by administration forces, led by Senator Wagner of New York and Chairman Thomas of Utah. The Senate Labor Committee majority, it is understood, is unwilling even to accept the House Labor Committee amend-

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Switchmen

Dr. Karl T. Compton (center), president of the Massachusetts Institute of Technology, as he turned the switch which started the first piece of testing apparatus in the Chrysler Corp. new dynamometer building at Highland Park. The building, said to be the most modern automobile engine testing and research laboratory in the world, is expected to be completed early in May. Assisting Dr. Compton at the "christening" ceremonies were F. M. Zeder (left), vice chairman of the board of Chrysler Corp. in charge of engineering, and Carl Breer, executive engineer and director of research.

Rate of Steel Operations Is Believed Close to Low Point

New Price Reduction in Lead Makes Third Cut in Two Weeks

While there is little change in the character of steel buying, representative tonnage commitments being conspicuous by their lack, current bookings, made up as they are of fill-in orders, show some improvement. More mills receive enough in the way of specifications and shipping orders every day to support operations at about one-half of their capacity, their output over and above that level being ear-marked for their reserve stocks. And then there are some producers, whose fresh bookings equal only about 40 per cent of their capacity, but many of whom still have a nest-egg of old commitments to sweeten their runs. Ernest T. Weir, president of the American Iron & Steel Institute, issued a statement, saying: "The rate of steel operations in the last couple of weeks indicates that the industry has reached the low point or pretty close to it for the time being. I still adhere to my earlier predictions that steel operations would remain at between 60 and 70 per cent of capacity until the end of the second quarter." Speaking of his own company, Mr. Weir said that its operations last week ran at about 75 per cent. Mindful of the difficulties of long-range planning amid the uncertainties of the war's repercussions on this country's business conditions and not overlooking the traditional cautiousness imposed by an election year, the present set-up in the steel market, which makes the buying of steel as needed the logical procedure, appears to meet with the approval of representative consumers, such as the large automobile manufacturers. A sign of the times was seen in the "permanent" shutting down in the Mahoning Valley of what was once perhaps the largest hand-operated sheet mill. A new list of extras was issued this week. Size extra on half-rounds, solid hot-rolled carbon steel bars were advanced approximately 25 cents per hundred pounds.

Consumers, among them at least one automobile manufacturer, took advantage of the low price at which tin was obtainable on Monday, April 1, when spot Straits tin was quoted at 44¾ cents. This indicated a decline of approximately $100 a ton from the March high. On Tuesday, April 2, however, the market turned firm and advanced to 45⅞ cents. The earlier decline was attributed in a large measure to unsettlement in the Far East markets in anticipation of the imposition of a 2½ per cent sales tax in the Federated Malay States. Sterling exchange was on the uptrend.

Sales of copper by custom smelters were made on April 2 at 11⅛ cents, $2.50 a ton below their previous quotation. Mine producers, however, adhered to their 11½ cent price, apparently feeling that little business was to be expected from a price cut. March sales of copper were the lightest in more than a year.

The leading marketer of lead announced another price reduction on Tuesday, April 2, the third cut in two weeks.—W. C. H.

MEN . . . . . .

E. J. Charlton has been appointed general manager of Lukenweld, Inc., a division of Lukens Steel Co. **G. L. Snyder** has been named chief engineer.

Otto C. Voss received the 1939 James Turner Morehead Medal, sponsored by the International Acetylene Association and awarded annually for outstanding work in the production or utilization of calcium carbide and acetylene gas. Presentation was made at the opening session of the association's recent convention in Milwaukee.

U. S. Rubber Co. announces the promotion of **Emmet Sheahan** to president of U. S. Tire Dealers Corp. He was formerly general manager of the automotive division.

L. M. Clegg, senior vice president, Thompson Products Co., Inc., has been promoted to executive vice president in charge of all plant and customer operations.

Y. D. Hills has been named assistant general manager, service-sales division of Timken Roller Bearing Co.

Ted Nagle, formerly director of sales, Bendix Radio Corp., automotive division, is president of the newly formed Ted Nagle Equipment Corp., Detroit. Available through the new company is the line of automotive and radio service test equipment formerly produced by Bendix. The organization is also doing development work on new products in this field, including an electric chassis dynamometer.

A new territorial arrangement adds two new assistant general sales managers to the De Soto division of Chrysler Corp. These are **D. M. Herrick** and **F. M. Hunt**.

F. N. Perry has been appointed sales manager of American Bosch Corp. He formerly had charge of the company's western division.

P. S. Parker, formerly works manager, Airzone, Ltd., Sydney, Australia, has become general manager of Frank G. Spurway & Sons, Ltd., Sydney.

The reelection of **E. S. Evans** as president and chairman of the board and

E. S. Evans, Jr., as executive vice president, and the election of **M. E. Stover** as treasurer and **J. C. Goldrick** as vice president has been announced by Evans Products Co.

P. E. Hovguard has joined Glenn L. Martin Co. as chief research engineer. He succeeds **J. B. Wheatley** who now assumes responsibility for the company's development work.

New Westinghouse Auxiliary Lamps

All-glass driving and passing lamps similar in construction to the Sealed Beam auto headlamp have been made available to manufacturers of housing and mounting equipment designed for their use by the Westinghouse Lamp division, Westinghouse Electric & Manufacturing Co. List price of the new units has been set at $1.10. Equipment manufacturers are expected to announce complete units soon.

Approximately two inches smaller in diameter than the standard Sealed Beam headlamps, the new units are designed to supplement rather than replace present lighting equipment on pre-1940 cars whose wiring systems are inadequate to handle the additional wattage required by the Sealed Beam System.

NADA Program

(*Continued from page* 387)

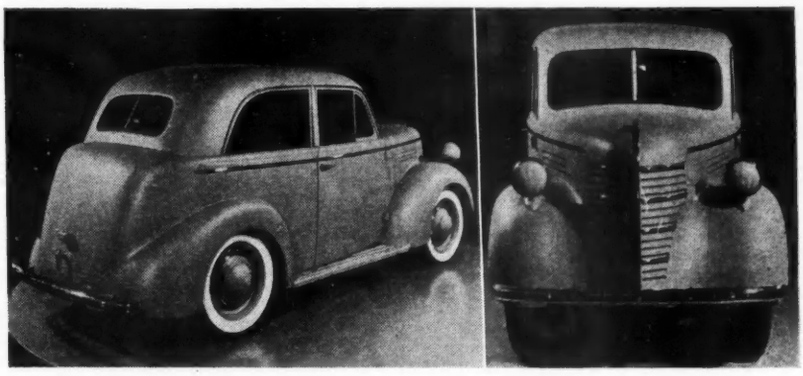
Congress. He charged that the phrasing of the questionnaire sent out to test dealer sentiment was stacked against the proposal, and that the timing of the poll with the Federal Trade Commission's proposed automobile trade practice rules greatly confused the issue. "I am convenced," he said, "that a large majority of the dealers do not know the true situation."

Mr. Horner, asked to comment on Representative Patman's opinion said, "Dealers are opposed to further government regulation in business. They have never favored it, but have always wanted manufacturers to do something for them to make dealer business profitable. We will now start all over again to see what may be done respecting manufacturer-dealer relations."

Pointing out that the N.A.D.A. is also overwhelmingly opposed to trade practice rules as redrafted by the FTC. Horner indicated that, in the absence of FTC's acceptance of rules as originally proposed by N.A.D.A., particularly the one regarding trade-in allowances, dealers will abandon plans for a trade practice program.

Graham-Paige Reports

Report of Graham-Paige Corp. for the year ended Dec. 31, 1939 shows a net loss of $1,406,627.24. Gross sales, less returns and allowances, for the year were reported as $3,327,039.84.



New Soviet Light Car

Preparations for the production of this new car, the Russian KIM-10, are said to be now in full swing. Completion of the plant is expected before the end of this year with production, to begin before the completion, expected to reach 15,000 in 1940. (See Automotive Industries issue of Mar. 15, p. 295.) For details of construction see news story on this page.

Plans Complete for Russia's New KIM-10

Russia's preparations for the production of its new light car, the KIM-10, are reported well under way. The four-passenger car will be offered in both coach and phaeton models with a 94 in. wheelbase, overall length of 155 in. and weight of 1760 lb. Top speed is claimed to be 61 m.p.h. with an average fuel consumption of 34 miles per gallon. Principal technical and design specifications are as follows:

Engine: four-cycle, four-cylinder, developing 30 b.h.p. at 4200 r.p.m. Displacement of 61 cu. in. Weight is 6½ lb. per h.p. Compression ratio is 6.06. Bore 2.5 in. and stroke 3.64 in. Cylinders cast in block, cast iron; detachable cylinder head made of the same material. Aluminum alloy pistons with three cast iron piston rings.

Fuel system: The engine is equipped with model MKZ-KIM-10 downdraft carburetor, fitted with an air cleaner. Fuel is supplied by a diaphragm pump from the 8½ gallon tank located at the rear. Intake manifold is heated by the exhaust.

Engine lubrication: Pressure feed to main bearings, camshaft bearings and connecting rod bearings. Splash feed throughout the remainder. Geared oil pump.

Cooling: Fin and tube core radiator of 1⅞ gal. capacity. Two-bladed fan mounted on generator shaft.

Electrical: Battery and coil ignition. Distributor driven by camshaft, with automatic adjustment. Six volt, 63 ampere hour storage battery and six volt 114 watt generator. Starting motor of 0.8 h.p.

Transmission: Three speeds forward and one reverse. Gear ratios—low, 3.07; second, 1.76; high, 1.00; reverse, 4.01. Second and high gears are synchronized.

Rear: Gear ratio of 5.5. Main gear is ordinary bevel with helical teeth. Differential is bevel with two planetary members. Three quarter floating. Propeller shaft is enclosed in a torque tube with reinforcing struts.

Steering: Worm type gear, ratio of 10.4.

Brakes: Mechanical on all four wheels. Hand brake operates on rear wheels only.

Suspension: Two transverse semi-elliptical springs. Car is equipped with four hydraulic shock absorbers.

Chassis: Pressed steel frame, two mm. thick, with three cross members and two reinforcing struts.

Wheels: Pressed steel, disk type. Tire size—5.00 by 16 in.

Body and equipment: Pressed all-steel body with two doors. Luggage carrier at rear. Adjustable front seat with collapsible back. On instrument panel are located ammeter, speedometer, electric gasoline gauge, clock, windshield wiper control, choke and starter controls.

Truck Production by Capacities

(U. S. and Canada)

	TWO MONTHS			Per Cent of Total	
	1940	1939	Per Cent Change	1940	1939
1½ Tons and less	129,546	118,300	+ 9.3	8.93	92.64
2 to 3 tons	9,761	5,422	+ 80.0	6.70	4.25
3½ Tons and over	1,804	1,824	+ 4.4	1.31	1.43
Special and buses	4,457	2,153	+107.0	3.06	1.68
Total	145,668	127,699	+ 14.0	100.00	100.00

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE INDUSTRIES**

Fluctuations of general business activity during the last two weeks indicate a resumption of the irregular decline that characterized the first quarter of the year. The New York *Times* seasonally adjusted index for the week ended March 23 receded to 94.1 per cent of the estimated normal from 95.0 in the preceding week, as against 88.5 a year ago. *The Journal of Commerce* unadjusted index stood at 93.5 per cent of the 1927-29 average, as compared with 95.4 for the week before.

Post-Easter retail trade last week reflected unseasonable weather in most regions, with sales totals ranging, according to Dun & Bradstreet estimates, from 4 to 8 per cent above levels a year ago. The corresponding margin of 10 to 16 per cent in the preceding week was largely attributable to the influence of Easter. Department store sales during the four weeks ended March 23 were 9 per cent greater than the corresponding 1939 total, according to the Federal Reserve compilation, as compared with a similar excess of 3 per cent for the four-week period ended March 2.

Production of electricity by the power and light industry declined by less than the usual seasonal amount during the week ended March 30 and was 9.6 per cent greater than the comparable output last year.

Railway freight movement during the week ended March 23 increased slightly, registering the first advance since that reported for the final week of February. Car loadings numbered 619,886, as compared with 634,410 three weeks earlier and 601,948 a year ago. Motor truck loadings during February exceeded by 17.5 per cent the corresponding 1939 tonnage.

Bank debits to deposit accounts (except inter-bank items) in leading cities during the thirteen weeks ended March 27 were 3 per cent above the comparable amount last year.

Crude oil production during the week ended March 30 averaged 3,841,250 barrels daily, exceeding by 340,650 barrels the required output as computed by the Bureau of Mines; the average daily excess production in the preceding week was 370,850 barrels.

Average daily output of bituminous coal during the week ended March 23 was 1,333,000 tons, as compared with 1,409,000 tons for the week before and 1,252,000 tons a year ago.

Sales of new ordinary life insurance, exclusive of group policies, during the first two months this year dropped 19 per cent below the comparable 1939 total.

Engineering construction awards during the first quarter of 1940, according to *Engineering News-Record*, were 20 per cent below the first-quarter total last year—a gain of 3 per cent in contracts for private work being overshadowed by a decline of 28 per cent in public projects.

Business failures during the week ended March 28 numbered 287, according to the Dun & Bradstreet report, as against 253 in the preceding week and 310 in the corresponding period last year.

Cotton-mill activity declined more than seasonally in the week ended March 23. The New York *Times* adjusted index stood at 133.5, as compared with 135.2 for the week before and 122.7 a year ago.

Professor Fisher's index of wholesale commodity prices was unchanged last week at 84.1 per cent of the 1926 average, the year's low to date, as against the maximum of 86.3 for the first week of January.

Excess reserves of the member banks of the Federal Reserve system rose $90,000,000 during the week ended March 27 to an estimated total of $5,680,000,000,. only $100,000,000 below the all-time peak reached a fortnight earlier. Business loans of the reporting members on the date totaled $4,383,000,000, or $569,000,000 more than the corresponding amount last year.

C. D. Wight

Clare D. Wight, secretary of *Automobile Topics*, died recently following an illness of more than six months. A well known figure in the automotive trade publishing business, Mr. Wight entered the publishing field as an office boy with the *Buffalo Express* in 1893. He went to Detroit in 1905 as western advertising representative of *Motor World* and *Motor Cycle*. In 1911 he joined Frank W. Roche in the publication of *Automobile Topics*. He had for several years been a director of the Detroit Racing Association.

Drawings Soon For Auto Show

Applications for floor space at the 41st annual National Automobile Show have been mailed by Alfred Reeves, manager of the exhibition scheduled for Grand Central Palace, New York, Oct. 12-20. Complying with the request of car and truck exhibitors for an early drawing to permit more time to prepare displays, the closing date for applications will be Thursday, April 25, with the first drawing scheduled for early in May. Order of drawings will be based on the dollar volume for the 12 months ending March 31, 1940.

GM Reports on 1939 Income

In its annual report to stockholders, General Motors Corp. indicates a net income of $183,403,399.48 for the year ended Dec. 31, 1939. Net income for 1938 was $102,310,036.29. Net sales for 1939 amounted to $1,376,828,337.39 as compared with $1,066,973,000.26 for 1938. There was an increase of 32 per cent, 1939 over 1938, in the number of passenger cars and trucks produced.

PUBLICATIONS

Bulletin No. 25 by Gar Wood Industries, Inc., illustrates and describes **hoists, bodies, winches, cranes, truck tanks and road machinery.***

Catalog 340 of Blackhawk Manufacturing Co. covers its new S-18 **service jack.***

A 112-page book titled **"Why Anti-Friction Bearings?"** has been published by New Departure division, General Motors Sales Corp.*

A folder on a new **silver electroplating** process has been released by Rapid Electroplating Process, Inc.*

Chicago Molded Products Corp. is publishing a monthly bulletin on **plastics** called "Plastic Progress."

Circular No. 115 by Lyon Iron Works covers Lyon **industrial trucks with hydraulic elevating tables.***

Federal Mogul Corp. has released its new bearing catalog. Produced in new form, the catalog lists 857 new **bearing** numbers. Complete information is contained on all model cars, trucks, tractors and marine engines.*

Bulletin 72-A of Niagara Machine & Tool Works illustrates and gives specifications concerning the company's new series of **power squaring shears.***

Marmon-Herrington Co., Inc., has released a folder describing its new model line of **heavy duty all-wheel-drive trucks.***

The 1940 edition of "Dodge and Diesel" has just come off the press. The booklet covers **Diesel engines** in general and the Dodge Job-rated Diesel in particular.*

Developments in Malleable Iron Practice and Their Automotive Applications, a paper presented at the S.A.E. World Automotive Engineering Congress, has been published in reprint form by Malleable Founders' Society.*

The 1940 edition of **Metal Statistics** has just been published. The 692-page book is available from the publisher, American Metal Market, 111 John St., New York City, at a price of $2.00 per copy.

"Take a Two Minute Trip Through the plant of Lansing Stamping Co." is the title of a new catalog released by that company giving an institutional view of its **pressed metal products.***

Thomas Laughlin Co. has published a folder illustrating and describing and listing competitive tests on its new **wire rope clips.***

Westinghouse Electric & Manufacturing Co. has released a booklet on its RLM **fluorescent lamp luminaries** with porcelain enameled reflectors.*

Data on **flexible fuel line replacements,** as well as many new items and price changes, are included in the new condensed catalog issued by Imperial Brass Mfg. Co.*

A new comprehensive bulletin describing the **crawler crane method of handling material** has been published by Bucyrus-Erie Co.*

The book, **Written Trade Agreements in Collective Bargaining,** prepared by the National Labor Relations Board, is available from the Superintendent of Documents, Washington, D. C., at 35 cents per copy.

*Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

Ourselves & Government

A Check List of Federal Action Corrected to Apr. 9

FEDERAL TRADE COMMISSION

VS. GENERAL MOTORS—Charge that dealers are required to handle GM parts exclusively. Testimony concluded. Examiner's report awaited.

VS. A. C. SPARK PLUG CO., G. M. subsidiary—Robinson-Patman and Clayton charges of discrimination in sale of spark plugs and accessories. No date for hearing set as yet.

VS. AUTOMOTIVE TRADE ASSOCIATIONS, including National Standards Parts and Motor and Equipment Wholesalers Associations — Charge of combination to control market and maintain resale prices. Negotiations for stipulation reported to be still under way.

F. O. B. PRICE CASE—Hearing in G. M. proceeding concluded and FTC brief is awaited. Ford case still open for further testimony.

FAIR TRADE PRACTICE RULES—NADA granted extension of time to file brief in opposition to FTC's proposed rules. Other statements, also in opposition, have been filed.

TEMPORARY NATIONAL ECONOMIC COMMISSION

Hearings begun April 8. Witnesses from automobile industry are C. F. Kettering, research engineer, General Motors; Edsel Ford, president, Ford Motor Co., and R. J. Thomas, president, UAW. (See news story on page 394.)

AUTOMOTIVE INDUSTRIES

Summary of Automotive Production Activity

BUSES Several Eastern cities reported making inquiries both for replacement and extension. Manufacturers have been talking details, prior to submitting bids, for extension of New York lines when city takes over two street railway systems.

TRUCKS Although not at maximum, production in many plants reported at highest point for many months. Strong and general buying reported by large users. One producer, who stepped up output in March 45 per cent over February, hit an all-time for that month and further increased output this month.

TRACTORS Anticipated let-up in buying failed to materialize and unusually high production schedules prevail. One of the largest producers now operating at capacity. Outlook is bright.

AUTOMOBILES Production for first half of April estimated at 225,000 cars and trucks, with expectations that this month's output may surpass March. AMA reports first quarter 23 per cent over same period 1939. One independent resumed production after nine months' lapse. (See page 394.)

MARINE ENGINES Decided buying trend in smaller power plants has increased output considerably—but still far from season normal. Large unit production reported favorable. Dealers report expanding market for all types and most makes.

AIRCRAFT ENGINES Backlogs continue to rise. Manufacturers reporting growing difficulty in obtaining enough good machinists and competent design and testing engineers.

This summary is based on confidential information of current actual production rates from leading producers in each field covered. Staff members in Detroit, Chicago, New York and Philadelphia collect the basic information, in all cases from official factory sources.

Reo Adds a Diesel Line

Reo's 1940 truck program has been augmented by a line of five Diesel-powered models ranging in capacity from 13,000 lb. to 22,000 lb. with corresponding tractor ratings, the company reports.

Each model will be built in three standard wheelbases of 120, 145 and 165 in. Optional wheelbases are obtainable on special order.

Buda-Lanova Diesel engines will be standard. Displacement of these engines are 226, 294, 317, 389 and 468 cu. in.

Transmissions are four or five speed of helical and spur gear design. Three types of axles—spiral bevel, double reduction and two-speed double reduction are available on each model.

New Passenger Car Registrations

	FEBRUARY 1940	JANUARY 1940	FEBRUARY 1939	TWO MONTHS 1940	TWO MONTHS 1939	Per Cent Change, Two Months 1940 over 1939	Per Cent of Total Two Months 1940	Per Cent of Total Two Months 1939	FOUR MONTHS MODEL YEAR 1940	FOUR MONTHS MODEL YEAR 1939	Per Cent Change
Chevrolet	55,661	65,945	38,544	121,606	85,015	+ 43.0	25.08	23.09	245,945	188,999	+ 30.0
Ford	37,742	42,824	30,773	80,566	68,314	+ 18.0	16.62	18.56	171,856	134,900	+ 27.2
Plymouth	28,923	32,987	23,956	61,910	53,916	+ 14.9	12.77	14.64	90,557	121,208	- 25.3
Buick	17,749	23,108	12,921	40,857	28,759	+ 42.2	8.43	7.81	92,305	66,590	+ 38.6
Dodge	14,556	16,514	12,401	31,070	27,988	+ 10.9	6.41	7.60	44,416	56,057	- 20.8
Pontiac	14,045	16,203	9,369	30,248	20,874	+ 45.0	6.24	5.67	66,497	46,614	+ 42.6
Oldsmobile	12,508	14,141	8,750	26,649	20,169	+ 32.1	5.50	5.48	60,226	45,572	+ 32.1
Chrysler	7,073	7,374	4,632	14,447	10,509	+ 37.5	2.98	2.85	20,325	21,306	- 4.7
Studebaker	6,569	7,147	3,011	13,716	6,511	+110.6	2.83	1.77	30,879	15,979	+ 93.5
Mercury	5,610	6,734	3,538	12,344	8,048	+ 53.4	2.54	2.19	26,473	14,883	+ 78.0
Hudson	5,216	5,737	3,032	10,953	6,592	+ 66.3	2.26	1.79	27,295	15,999	+ 70.6
De Soto	5,076	5,137	3,190	10,213	7,142	+ 43.1	2.11	1.94	15,146	15,227	- 0.5
Packard	4,875	5,271	2,664	10,146	5,752	+ 76.5	2.09	1.56	24,973	14,819	+ 68.4
Nash	3,582	4,335	3,308	7,917	7,208	+ 10.0	1.63	1.96	17,538	12,812	+ 37.0
Lincoln	1,543	2,008	1,379	3,551	3,317	+ 7.0	.73	.90	7,577	6,679	+ 13.4
Willys	1,479	1,678	747	3,157	1,725	+ 83.0	.65	.47	7,081	3,647	+ 94.0
La Salle	1,359	1,741	1,308	3,100	3,102		.64	.84	8,302	7,706	+ 7.9
Cadillac	878	1,144	918	2,022	2,200	- 8.2	.42	.60	4,768	4,856	- 1.8
Bantam	97	78	54	175	118	+ 48.2	.04	.03	326		
Crosley	36	51		87			.02		194		
Graham	24	37	277	61	627	- 90.3	.01	.17	169	1,341	- 87.4
Hupmobile	6	8	36	14	97	- 85.6		.03	34	198	- 83.0
Fiat	1	5	16	6	31	- 80.7		.01	15		
Miscellaneous	17	9	118	26	140	- 81.4		.04	59	538	- 90.0
Total	224,625	260,216	164,942	484,841	368,154	+ 31.8	100.00	100.00	962,956	795,980	+ 21.0
Chrysler Corp.	55,628	62,012	44,179	117,640	99,555	+ 18.0	24.26	27.05	170,444	213,798	- 20.3
Ford Motor Corp.	44,895	51,566	35,690	96,461	79,679	+ 21.0	19.90	21.64	205,906	156,462	+ 31.6
General Motors Corp.	102,200	122,282	71,810	224,482	160,119	+ 40.0	46.30	43.49	478,043	360,337	+ 32.8
All Others	21,902	24,356	13,263	46,258	28,801	+ 60.5	9.54	7.82	108,563	65,383	+ 66.0

Necessity Calls for Inventors, Kettering States at Hearing

GM Executive Tells TNEC Inventions Aid Employment

Assured optimism that the future holds a treasure of great and good things for all to share jobs and of enough jobs for all to do was given the Temporary National Economic Committee on April 9 by Charles F. Kettering, vice-president of General Motors Corp., in charge of research. The committee is holding hearings relating to technological developments and their impact on labor.

Mr. Kettering, answering claims that unemployment has been produced by too many inventions definitely took a reverse stand. He said the facts are that there aren't enough new things to provide sufficient jobs for all of the people who want work.

"Today," he said, "Necessity is again calling for the inventors to produce new things because we have more hands than we have jobs today."

Mr. Kettering told the committee that "Somehow, because you are Americans, you demand and think you have a right to expect more value, more usefulness from everything you buy and I think you have." That, he said, is why the tempo of progress is speeding up. American industry, Mr. Kettering declared, is cultivating ideas as its richest investment in the future.

"We are looking for young Marconis, young Bells, young Edisons," said Dr. Kettering. "We have many of them in our laboratories now. We encourage them. They are taught to look upon progress as a road that has no end.

"If we give them the opportunity of free enterprise, they will contribute freely. In every industry—those existing and those to come—their improvements will demonstrate clearly that what we have today is not enough or good enough. This is why, with all conviction, I say that the future is boundless."

Dr. Kettering said that a progress of cooperative invention surely will bring into our new industrial machinery many new products and improvements.

"In the field of automotive transportation, with which I am most familiar," he continued, "we are not even predicting when you hear that the next 10 years will show a rate of improvement greater than that of the past 10 years. This fact is established as clearly as anything in the future can be established. Scores of research projects are now under way in the industries which make automobiles, trucks, buses, tractors, airplanes, and Diesel locomotives. This is also true in every one of the industries which make and supply the materials for our industry, such as petroleum, rubber, steel, fabrics, chemicals, etc. Success in only a small percentage of the projects now in mind will give American workmen thousands of new jobs and will increase the value of the transportation dollar more than can now be realized. Statistics show that of the millions of people who earn a living in the automotive transportation business only about 10 per cent are employed in making the vehicle."

Mr. Kettering pointed out that in the management of the automotive and associated industries there are executives who have learned how to spend money

(*Turn to page 398, please*)

Two-Month Automotive Exports and Imports

	FEBRUARY 1940		FEBRUARY 1939		TWO MONTHS ENDED FEBRUARY, 1940		1939	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, parts and accessories		$ 23,834,998		$ 25,335,229		$ 47,570,892		$ 46,731,439
PASSENGER CARS								
Passenger cars and chassis	9,692	6,135,741	16,040	9,907,164	23,026	13,948,069	31,016	18,818,244
Low price range $850 inclusive	8,350	4,759,088	14,007	7,733,833	20,265	11,129,702	27,348	14,917,779
Medium price range $850 to $1,200	1,177	1,118,720	1,736	1,668,680	2,438	2,312,719	3,144	3,018,572
$1,200 to $2,000	152	221,883	243	376,702	295	429,153	430	656,263
Over $2,000	13	36,050	54	129,949	28	76,495	94	225,630
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	10,286	8,967,086	11,135	6,927,375	19,824	15,178,104	19,951	11,951,672
Under one ton	1,232	583,247	1,522	624,504	2,787	1,229,693	2,708	1,114,541
One and up to 1½ tons	5,524	2,953,583	7,524	3,867,155	12,221	6,449,519	14,228	7,283,017
Over 1½ tons to 2½ tons	2,499	3,410,326	1,502	1,268,004	3,471	4,602,836	2,134	1,839,380
Over 2½ tons	955	1,894,191	409	1,053,121	1,266	2,767,382	672	1,570,793
Bus chassis	76	125,739	178	114,591	79	128,674	209	143,941
PARTS, ETC.								
Parts except engines and tires		4,009,664		4,231,674		9,142,343		7,740,074
Automobile unit assemblies		3,493,079		2,942,912		6,673,992		5,756,751
Automobile parts for replacement (n.e.s.)		407,807		243,157		756,946		544,012
Other automobile accessories (n.e.s.)	303	313,753	1,748	462,481	1,049	597,898	2,800	927,317
Automobile service appliances	170	14,522,442	114	4,165,859	376	30,468,851	186	6,711,781
Airplanes, seaplanes and other aircraft		20,599,703		6,772,182		41,080,520		11,664,400
Parts of airplanes, except engines and tires								
INTERNAL COMBUSTION ENGINES Stationary and Portable								
Diesel and semi-Diesel	54	117,176	24	34,996	125	306,038	40	112,877
Other stationary and portable								
Not over 10 hp.	1,444	83,659	928	60,018	2,633	151,466	1,426	93,985
Over 10 hp.	168	162,595	123	87,873	467	333,312	194	163,651
Engines for:								
Motor trucks and buses	1,990	187,610	2,856	331,113	4,442	479,372	5,033	579,778
Passenger cars	2,189	187,588	3,296	277,158	4,870	410,603	4,951	416,884
Aircraft	285	2,541,415	90	676,051	649	5,855 565	184	1,263,997
Accessories and parts (carburetors)		417,052		205,766		700,214		392,432
IMPORTS								
Automobiles (dutiable)	38	34,523	30	23,539	94	103,392	75	60,086

Shipments Started On Graham Seniors

First step in the new Graham-Paige Motors Corp. three-phase production program was completed April 3, when the first of the new Graham "Senior" cars rolled off the final assembly line. Shipments to distributors and dealers are now under way, with the cars scheduled for public display as fast as they are received at merchandising outlets.

Second phase of the program is the building of a completely new line of automobiles, named the "Hollywood" last summer when plans for the car were first drafted. These models are already in production, the company reports, and are scheduled for early national display.

Third phase is the building of new "Clipper" cars, styled in the "Hollywood" manner but designed for a lower price field. These cars are now undergoing final engineering checks, and will reach the market in late spring, it is reported.

In the new Graham Seniors, the company is offering four different lines of cars: The DeLuxe, the DeLuxe Supercharger, the Custom, and Custom Supercharger. Each line comprises three body types: 4-door sedan, 2-door sedan and combination coupe. An increase in power is included. The engine is a six-cylinder L-head type, 3¼ in. bore and 4⅜ in. stroke, with a displacement of 218 cu. in. Engines on all lines have a standard compression ratio of 6.65 to 1. Optional ratios of 7 to 1 and 7.25 to 1 are available.

Power has been stepped up this year to 120 h.p. in the supercharged motor, and to 92 h.p. in the unsupercharged motor. This has been accomplished by changes in cylinder head design and new carburetion, which also provides automatic choking.

Electric Auto-Lite Reelects Directors

At its annual meeting, stockholders of Electric Auto-Lite Co. reelected directors and added Frank J. Kennedy, auditor, to the board. Those reelected included C. O. Miniger, chairman; R. G. Martin, president; D. H. Kelly, executive vice president; B. A. Fay and Walter V. Flood, vice presidents; J. H. Householder, treasurer; Frank H. Landwehr, secretary; Russell McGee and H. E. Talbott. Officers will be named at the meeting of the board on April 24.

The annual report of president Martin showed net sales of $5,346,032 for 1939—a gain of 43 per cent over the previous year. Net earnings were $5,653,839 as compared with $1,836,149 in 1938.

Packard Recovers Nine-Month Loss

Packard Motor Car Co. has reported net earnings for 1939 of $545,867. For the nine months ended Sept. 30 last, the company reported net loss of $2,050,092 against net loss of $3,298,790 in the first nine months of 1938. The company produced, 76,573 cars last year, as compared with 50,260 in 1938.

Allis-Chalmers Has New Model

A new Diesel crawler tractor, the HD10, has been introduced by Allis-Chalmers Manufacturing Co. as a companion model to the recently announced HD14. The four cylinder engine provides 86 belt hp. and 71.2 drawbar hp. with drawbar pulls up to 17,600 lb. The tractor is available in two tread widths, 62 and 74 in., with the narrow model weighing 19,900 lb. and the wide model 20,700 lb.

Constant-mesh gears permit shifting on the go and, because the engine can be throttled down to almost half engine speed without losing drawbar pull, a speed range is provided from 1.58 to 5.67 m.p.h.

Fairchild Reports $422,744 Profits

Fairchild Aviation Corp. and subsidiary is reported as showing a 1939 net profit of $422,744, compared with $322,473 in 1938. Unfilled orders on hand Feb. 29 totaled $2,161,140 as against $1,923,201 at the end of 1939 and $1,070,338 at the end of 1938.

Houde Expansion

Houde Engineering Corp., Buffalo, N. Y. has acquired an additional seven acres of ground and plans a $300,000 expansion program. Details of the plans are not yet available.

40 YEARS AGO

C. C. Bramwell, Hyde Park, Mass., has been experimenting for several years to produce a reliable jacketless motor of sufficient power to propel a light carriage. The motor, which weighs 180 lb., works on the Otto cycle.

A particularly interesting feature of this motor is the valves, especially the exhaust valve, which is one of the chief difficulties in an unjacketed motor. All the valves have large bearing surfaces, and the exhaust valve is so constructed as not to be injuriously affected by the heat. The stem is elongated, bringing the spring away from the heat and preventing loss of its temper. This valve can be taken off, seat and all, in less than five minutes, and if an extra one is taken along in the tool box it can easily be substituted on the road and the old one can be reground if desired.

The inlet valve is also easily got at. It can be taken out, seat included, in two minutes, giving access to the spark mechanism, which is of the primary or low tension kind.

From *The Horsless Age*, April, 1900.

Bendix Acquires Degasser Rights

Announcement has been made of an agreement whereby Bendix, through its Zenith and Stromberg carburetor divisions, will have world distribution of the Leibing Degasser. The primary object of the degasser is to eliminate gas fumes but the method by which it is accomplished, the company reports, frequently results in fuel economies. In the past there has been a limitation of use because special provisions are required on carburetors to install the degasser. However, it was stated that these two carburetor manufacturers will soon be in a position to supply a number of carburetor types to accommodate this unit.

Start Production Of New Carburetor

The recently formed Winnipeg Carburetor Co., Winnipeg, Man., has announced start of production of a new type carburetor. Invention of the carburetor is credited to L. H. Torell and tests of it have been under way since last November, according to W. S. Kickley, managing director, who resigned the general managership of Dominion Motors to take charge of the new company. A separate company is reported being formed to handle production and sales in the United States. Although no price has been set as yet for the new unit, it is expected to cost around $30.

Simplex Offers New Force Feed Lubrication

A simple form of fully automatic, force feed lubrication for trucks, tractors, passenger cars, and machinery is offered by the Simplex Mfg. Co., Detroit, Mich. It consists of a spherical metal container, holding ¼-fluid ounce of oil or grease, with an extruded threaded end for attachment and a standard nipple for filling. Sealed within the container is a small hollow ball filled with air, the ball being made of Neoprene which is claimed to be impervious to the action of oil or grease and capable of long life under the operating conditions.

The principle of operation is quite simple: when grease is forced into the lubricator by a pressure gun, it collapses the ball, thus compressing the trapped air and storing up energy which keeps a constant pressure on the lubricant. After the lubricator has been filled, the grease flows quite rapidly until the pressure within is balanced with the resistance in the bearing. Thereafter the lubricant issues only when the bearing is in motion, in a sort of wiping action. A modern motor truck will require about 30 of these lubricators, on the average, to take care of the important lubrication points.

CALENDAR

Conventions and Meetings

Chamber of Commerce of the United States, Annual Convention, Washington, D. C. .....April 29-May 2
American Society of Mechanical Engineers, Spring Meeting, Worcester, Mass. .....May 1-3
American Foundrymen's Association, Convention, Chicago .....May 6-10
SAE National Production Meeting, Hartford, Conn. .....May 7-8
SAE Summer Meeting, White Sulphur Springs, W. Va. .....June 9-14
Automotive Engine Rebuilders Association, Convention, St. Louis, Mo. June 10-13
American Society for Testing Materials, Annual Convention, Atlantic City, N. J. .....June 24-28
National Automobile Dealers Association, Convention, Pittsburgh, Pa. Jan. 20-23, 1941

Shows at Home and Abroad

National Automobile Show, Grand Central Palace, New York.....Oct. 12-19
National Metal Congress & Exposition, Cleveland, O. .....Oct. 21-25
Automotive Service Industries Show, Chicago .....Dec. 9-14

Kettering Comments On Patent Progress

(*Continued from page 9*)

poor conductors of electricity, or heat, or sound? Answers to any one might profoundly affect our present machines. Any one might lead to vast new industries and create another labor shortage."

Dr. Kettering listed the following 10 lines of "unfinished business":

Adequate housing; modern highway system; preventatives and cures for man's ills, such as colds and cancer, etc.; communications, including facsimile transmission and television; air conditioning; fundamental information in the basic sciences of physics and chemistry; knowledge on plant growth for better agriculture; improved transportation systems, including land, water and air; more efficient modern cities; and better knowledge of the properties of materials both natural and synthetic.

Dr. Kettering continued:

"It is a fallacy to believe that we have reached the end of the road of progress. The frontiers of science and industry ahead hold promise of new jobs and new improvements in the standard of living surpassing even the progress of the past which has made this the most envied nation on earth."

ADVERTISING

Champion Spark Plug Co. will stage its sixteenth annual "National Change Week," May 6-12, with an extensive consumer advertising campaign in newspapers and magazines emphasizing the benefits of replacing worn spark plugs. Retail sales points will be supplied with elaborate window trims, displays and banners.

Electric Auto-Lite Co. has announced a nation-wide billboard campaign for April and May, promoting Auto-Lite spark plugs. Four types of poster designs will be used, and will be displayed in 415 cities and towns. A merchandising kit which enables car dealers, garages and service stations to tie in with the campaign is being distributed by the company. The billboard campaign, being used for the second time, supplements advertising in general magazines and farm publications.

C. W. Bolan, advertising manager, Carter Carburetor Co., **C. B. Dietrich,** advertising manager, Wagner Electric Corp., and **James Tate,** vice-president, Delta Manufacturing Co., are among the automotive men listed to speak at the National Industrial Advertisers Association mid-west regional conference to be held in Chicago on April 19.

Oscar F. Jackson, of the advertising agency of the same name, Lansing, Mich., has been appointed as an instructor at Michigan State College to teach a course in applied advertising art, as a side line to his activity in the advertising field.

At the annual election of officers of the Advertising and Sales Club of Windsor, Ont., **John C. McGuire,** executive of Chrysler Corp. of Canada, Ltd., was returned as president. Vice-presidents for the 1940-41 term include **Ellis Millard,** Ford Motor Company of Canada, and **Newt. E. Irwin,** Goodyear Tire & Rubber Co., of Canada, Ltd. Among the directors are **A. M. Miller,** director of advertising of the Chrysler Corp. of Canada Ltd., and **C. A. Speers,** Champion Spark Plug Co. of Canada, Ltd.

General Tire & Rubber Co. of Canada, Ltd., Toronto, Ont., will have the biggest newspaper advertising campaign since entering the Canadian market six years ago, states **V. P. Reid,** vice-president and general manager. The company had a most successful year in 1939 remarked the president. They are going into 71 markets across Canada, using daily and weekly newspapers. The campaign will begin in May.

Inventions Needed

(*Continued from page* 394)

to give research men the opportunity to think. The are, he stated, providing tools to make ideas come alive.

He said that he thinks particularly of the automobiles of tomorrow, the airplanes of tomorrow. They are being built right now, he added, in secluded laboratories by specialists in fuels, metals, ceramics, rubber, plastics, by designers of engines, by petroleum technologists, by others who are devoting their lives to improving such humble but indispensable engine parts as valves and fuel pumps, lubricants and gasoline, for these oil products were said to be now as much a part of the engine design as the crankshaft and pistons.

"We who make automobiles are not satisfied with the fine new model that rolled off the production line today. It may be the best car that has been built up to now," Dr. Kettering said. "But tomorrow, so help us, we'll build a better one. The chemists who spin a silken thread from a magic brew of air and water, turn back to their laboratories bent on new discoveries. The petroleum engineer makes a better gasoline. Now, he says, we'll make it cost less. And he does."

Steam Engine With Light Metal Pistons

A steam engine of revolutionary design, weighing only a fraction of the conventional type and utilizing light metal pistons for the first time in a steam engine, is claimed to be in the process of development in Germany, according to reports received by the Commerce Department.

Developed by Dr.-Ing. Lentz, well known construction engineer, the engine will permit a saving of 30 per cent in space with a steam consumption of only 70 lb. per hp. and a power utilization of 92 per cent. The Lentz engine utilizes a multiple-cylinder, even-pressure system and has three, six or nine cylinders arranged on one crankshaft. Its design was described as similar to that of an internal combustion engine with no cross head.

Designed principally for use on ships, the new engine operates at a high number of revolutions per minute, the report said.

Continental Motors Sets 15-Year Peak

Continental Motors Corp. reports a net profit of $94,875.12 after all charges for the first quarter ended Jan. 31, 1940, compared with net loss of $141,664.00 reported for the corresponding period year ago. The earnings for the quarter were the greatest the Company has had for the comparative quarter since Jan. 31, 1925. Unfilled orders on hand March 8, 1940, were $5,719,000.00 compared with approximately $2,903,450.00 year ago.

Reo Reorganization Fees Are Reduced

Requests for fees totaling $120,616 for services in the reorganization of the Reo Motor Co. have been drastically slashed to $38,780.49 by Judge Arthur F. Lederle in Federal Court in Detroit. This was below the $55,992 which had been authorized by the Securities and Exchange Commission.

Largest individual sum of $5,500 went to Ferris D. Stone, Detroit attorney and chairman of the Creditors' Committee. A group fee of $22,000 was authorized for Edmund C. Shields, Byron L. Ballard, C. F. Jennings, C. R. Taber and D. R. Bishop, Lansing attorneys.

The reorganization plan for the new Reo Motors, Inc., was approved Jan. 2, 1940. The New York Stock Exchange on April 10 admitted to listing the voting trust certificates for capital stock of $1 par value of the new corporation. This action suspended dealings in the Reo Motor Car Co. capital stock of $5 par value.

Reo will resume production on its new line of trucks and buses early in May.

Borg-Warner Corp. Reports on Finances

The recently released Borg-Warner Corp. report to stockholders indicated net earnings for the year ended Dec. 31, 1939, as $5,683,801. This compared with a net loss of $19,966 for 1938. Borg-Warner entered the aviation industry in April, 1939, through the purchase of the capital stock of Pump Engineering Service Corp.

Canadian Financing Increases 30 P.C.

Financing of new and used motor vehicles in Canada during February gained 38 per cent in number and 43 per cent in amount of financing over February, 1939. There were 9,517 vehicles financed in February this year for $4,188,923 compared with 6,897 for $2,920,337 in the same month of 1939. Cumulative totals for January and February showed 17,438 units financed for $7,750,090 in 1940, 30 per cent in number and 35 per cent in amount above the first two months of 1939.

Job Benefits

(*Continued from page* 388)

at plants in Michigan—35,636 in Flint, 26,289 in Detroit, and 11,391 in Pontiac.

The election, which will be by secret ballot, will be held on company property and company time. Voters will have a choice between the UAW-CIO, UAW-AFL or neither union.

In the labor board case against the Ford Motor Co. at Dallas, Tex., involving charges of unfair labor practices, R. L. Denham, Trial Examiner, is studying 4400 pages of transcript from the 27-day hearing. Denham will make an intermediate report to the NLRB in Washington with findings of facts and conclusions. A definite decision is not expected before May 1.

Norton Bill

(*Continued from page* 389)

ments in their entirety. But, it is reported, that as a matter of jockeying labor legislation into inaction at the present session it might accept the amendments in their present or modified form, and put them through the Senate. Going to conference, the legislation could be stalled up to adjournment by the simple process of studied disagreement between Senate and House conferees.

Senator Wagner has said he would approve the amendment to enlarge the board and the amendment to grant employers the right to petition the board for election in case of representative disputes between rival unions. Actually the board, yielding to pressure, has revised its rules to permit such elections.

The most controversial Norton amendment centers around determination of the proper bargaining unit. The craft amendment, Mr. Green says, will not bar industrial unions. He claims it merely gives the workers the right to decide whether they want a craft, plant or industry-wide unit. Mr. Lewis on the other hand says that "The craft amendment, in particular constitutes a declaration of war on CIO industrial unions and will be vigorously fought as a threat to the very existence of our organization." The amendment, he said, would put every established industrial union "in constant danger of division and destruction through the slicing off of craft splinter groups, even in the face of existing industrial union contracts."

Going further, Mr. Lewis said that CIO and the non-Partisan League will conduct a national campaign against the Norton amendments and "all other amendments to emasculate the Wagner act, defeat its basic purposes and turn it into an instrument for the oppression of labor."

While Mr. Lewis has turned thumbs down on the New Deal and therefore the administration does not feel obliged to pet and pamper him as much as in the days of their political affiliation, his voice still attracts administration attention.

MEN and MACHINES

(*Continued from page 378*)

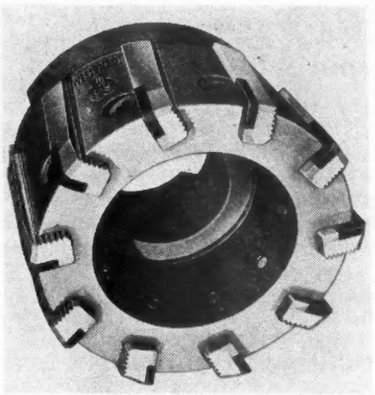
Flock gun designed for rapid application of flock when supplied from a flock pressure tank or mechanical feed hopper. Body of gun is forged brass, nickel plated. Pistol grip handle of aluminum alloy. When double action trigger is fully drawn back, a wide continuous stream of flock is delivered. Slight pull on trigger releases blast of clean air for blowing off excess flock. Known as Type FF-¾ in. *Paasche Airbrush Co., Chicago.*

New abrasive type wheel especially designed for weld grinding and snagging. Designated as Type AK. *Atlantic Abrasive Corp., South Braintree, Mass.*

Polishing machine for light buffing and coloring to take place of heavier machines for the same work. Consists of head and stand and is driven by ¼ hp. a.c. or d.c. motor which is mounted on the stand. *Lewis Roe Mfg. Co., Brooklyn, N. Y.*

Set of magnetic parallels and V blocks for use with magnetic chucks, known as Magne-Blox. Made of alternate laminations of brass and specially selected iron of high magnetic capacity, the Magne-Blox set consists of two parallels measuring 1 in. by 1¾ in. by 3¾ in. and two V blocks measuring 1¾ in. by 2⅜ in. by 1⅞ in. Intended especially for surface grinding operations on odd pieces, irregularly shaped dies, jigs and fixtures, cylindrical work and numerous diversified forms, which because of their unusual construction cannot be held directly on the face of the magnetic chuck. *George Scherr Co., Inc., New York.*

"Doall" height and depth gage designed to facilitate obtaining of measurements of micrometer accuracy in "hard to get at places." *Continental Machines, Inc., Minneapolis.*—H. E. B., Jr.



This inserted blade milling cutter is part of the new Wesson line of standard cemented carbide tools.

SEC Reports Increase in Assets of Aircraft Firms

A $62,000,000 aggregate increase in assets for 19 aircraft manufacturers between 1935 and 1938 is disclosed by the Securities and Exchange Commission in a report on nine industries covered in a recent SEC survey.

Aircraft manufacturers were the only group covered which showed a yearly increase in assets, net profits, business volume and dividends paid.

In most of the industries, a gain was shown over 1934 or 1935 but declines were registered from 1937 to 1938. In the aircraft industry, net profits increased from $3,000,000 in 1935 to $20,000,000 in 1938, while assets went up from $97,000,000 to $159,000,000.

J. T. Rainier

John T. Rainier, 79, one of the nation's first automobile manufacturers, died recently in Hewlett Harbor, N. Y. In 1906 he established a factory in Saginaw and his cars were famous racers early in the century. His company was one of the firms combined to form the General Motors Corp. in 1908.